DCS-3950 series Ethernet Switch Manual

Version 1.4

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Preface

DCS-3950 series is a high performance ethernet switch which support wire-speed Layer 2 switching.

DCS-3950 series can seamlessly support various network interfaces from 10Mb, 100Mb, 1000Mb Ethernets.

DCS-3950 series is an excellent choice as access layer switch for education, government and large/medium enterprise networks..DCS-3950 series comprises DCS-3950-26C, DCS-3950-28CT, DCS-3950-28C and DCS-3950-52CT, DCS-3950-52C. , DCS-3950 series provide 24 10/100 ports+2 Gigabit Ethernet fiber/copper ports; 24 10/100 ports+2 Gigabit Ethernet fiber/copper ports +2 Gigabit copper ports ;24 10/100 ports+4 Gigabit Ethernet fiber/copper ports;48 10/100 ports+2 Gigabit Ethernet fiber/copper ports +2 Gigabit copper ports;48 10/100 ports+4 Gigabit Ethernet fiber/copper ports.

We are providing this manual for your better understanding, using and maintenance of the DCS-3950 series. We strongly recommend you to read through this manual carefully before installation and configuration to avoid possible damage to the switch and malfunction.

Software or hardware of the product may be updated after the release of this manual. And if this manual should be updated according to the product update, it is not promised the customers would be informed about the update. To get more information about the product, or to get software updates or manual updates, please go to http://networks.digitalchina.com or dial 800-810-9119(in China) to get support.

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Chapter 1 Introduction of Products

1.1 Brief Introduction

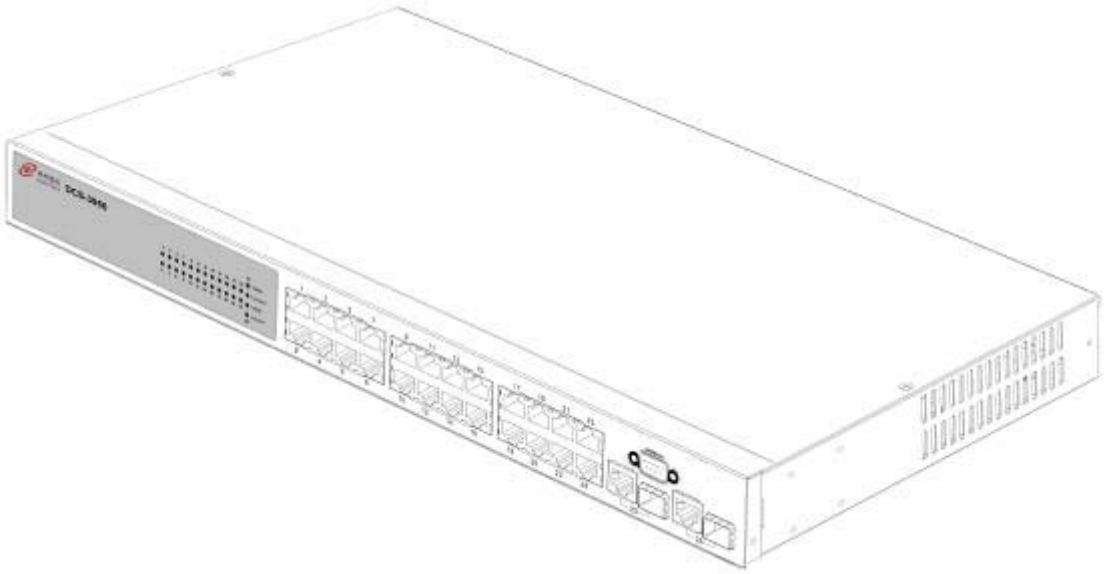


Fig 1-1 DCS-3950-26C switch

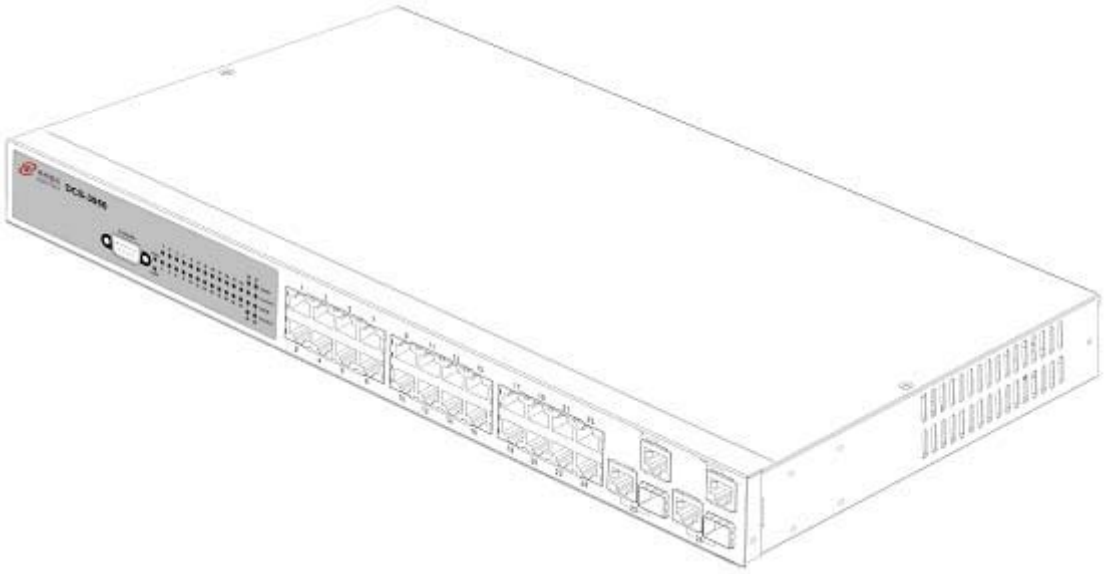


Fig 1-2 DCS-3950-28CT switch

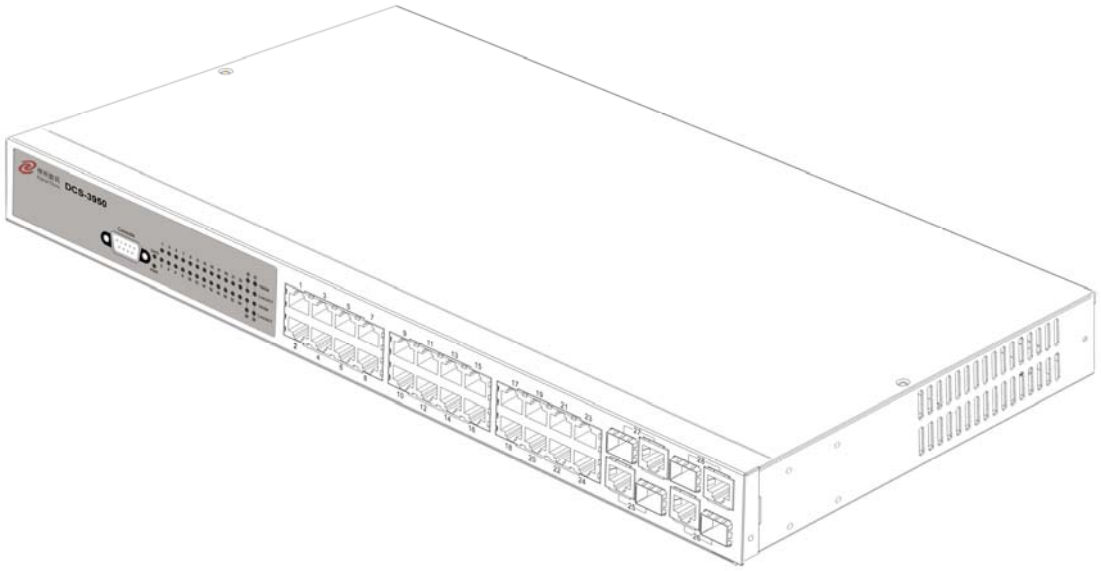


Fig 1-3 DCS-3950-28C switch

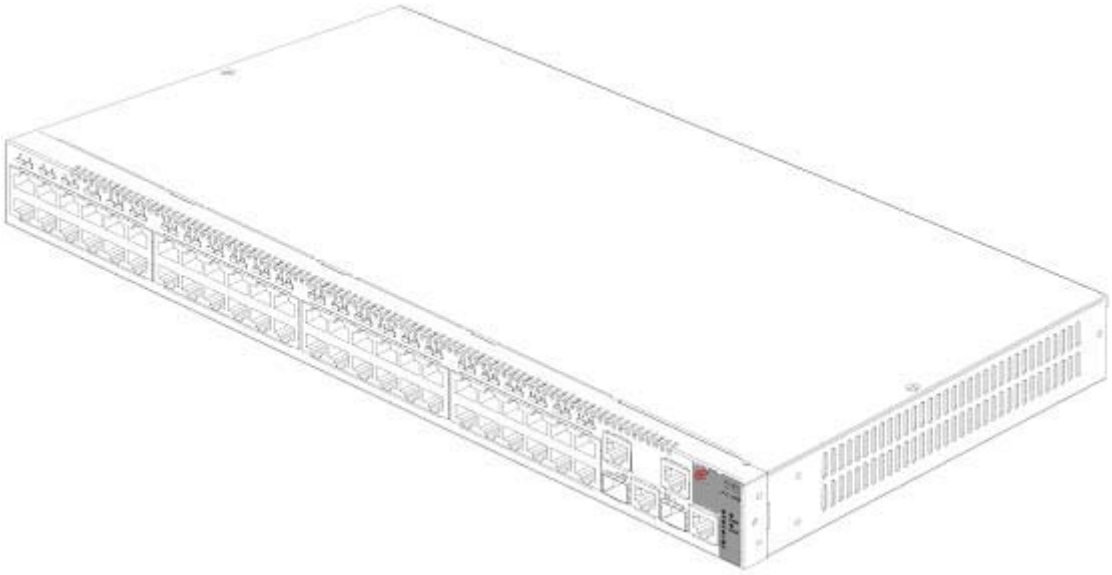


Fig 1-4 DCS-3950-52CT switch

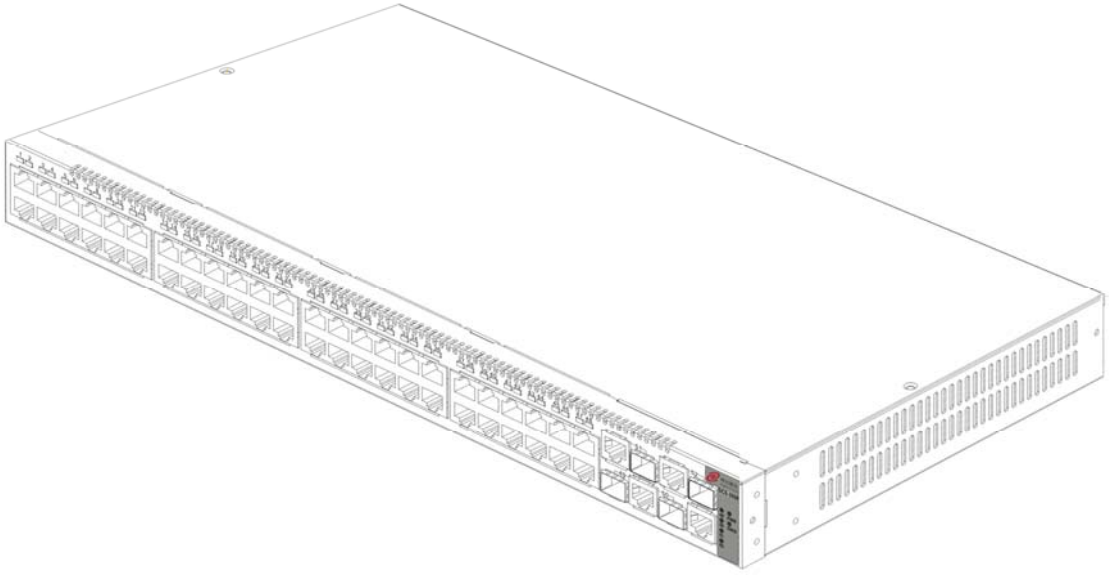


Fig 1-5 DCS-3950-52C switch

1.1.1 Overview

The DCS-3950 series Intelligent Stackable Secure Ethernet Access Switch can not only be utilized in large-scale enterprise networks，campus networks and metropolitan area networks as access equipment, but also can meet the demand for network of medium-scale office environment. This series of switch has unique network access functions and flexible management of network, including MAC binding/filtering, limiting the total number of Mac addresses, IEEE802.1Q VLAN, PVLAN, IEEE802.1x access authentication, QoS, ACL, bandwidth control, IEEE802.3ad TRUNK, IGMP Snooping, broadcast storm suppression, IEEE802.1d/w spanning tree, port mirroring and so on.

1.1.2 Features and Benefits

- **MAC Address Control**

Besides the standard dynamic learning capability of MAC address, the DCS-3950 series also supports several other methods of management based on the MAC address list. The MAC address binding function can restrict the MAC addresses of access equipment connected to a port, in order to keep access secure. The MAC address filtering function can filter according to source and destination MAC addresses to block the invalid access equipment.

- **VLAN Configuration**

The DCS-3950 series supports standard IEEE802.1Q VLAN, port-protect VLAN and PVLAN. IEEE802.1 Q VLAN can divide ports into several VLAN groups, the upper limit of which is 4094. It can also do multi-switch VLAN division via IEEE802.1 Q VLAN tag, and thus manage to control broadcast traffic, guarantee the security and performance of the

network at the same time. PVLAN function can divide ports into isolated ports and community ports, in order to isolate or connect ports as demanded by network applications.

- **QoS**

DCS-3950 series fully support QoS policy. Users can specify 4 priority queues on each port. WRR/SP/SWRR scheduling is also supported. DCS-3950 series also supports the port security. The traffic can be sorted by port, VLAN, DSCP, IP precedence and ACL table. User can also modify packets' DSCP and IP precedence values. Users can specify different bandwidths for voice/data/video to customize different qualities of service.

- **ACL**

DCS-3950 series supports complete ACL policy. ACL is a mechanism realized by switches to filter IP data. By allowing or denying specific data packets entering/leaving the network, a switch can control the network access and effectively guarantee the secure operation of network. DCS-3950 series supports IP -based, MAC-based and MAC-IP-based ingress filtering, it can also filter data based on the information of source/destination IP address, source/destination MAC address, IP protocol type, TCP/UDP port, IP precedence, time range and ToS, etc..

- **IEEE802.1x Access Authentication**

The DCS-3950 series not only supports port-based IEEE802.1x authentication mode, but also supports MAC -based authentication mode. It can set the upper limit of access authentication users per port, realize dynamic secure authentication mode basing on MAC address, and bind the MAC address of authenticated equipment to a port. Combining these IEEE802.1x authentication modes with the authentication and cost-counting products of the Digital China Networks Limited, we can supply a whole set of integrated IEEE802.1x access authentication and cost-counting resolution to satisfy the need of access, authentication and cost-counting, ensuring the network's security and its ability to operate.

- **Bandwidth Control (Speed Limit of Port)**

The DCS-3950 series can control the upstream/ downstream bandwidth and provide different access bandwidth for users of different levels. Each port can set its bandwidth rate as demanded to meet the need of access network to control access bandwidth.

- **TRUNK**

The DCS-3950 series supports IEEE802.3ad standard TRUNK. It can also realize link redundancy and traffic load balance.

- **IGMP Snooping**

The DCS-3950 series supports multicast applications which are based on IGMP Snooping mechanism, and as a result, it can realize all kinds of multicast services, diminish the network traffic and meet the requirement of multicast services like multimedia playing, remote teaching and entertainment.

- **Broadcast Storm Suppression**

The DCS-3950 series supports broadcast storm suppression, can effectively control broadcast storm, decrease useless occupancy of bandwidth, and increase the overall performance of network.

- **Spanning tree**

The DCS-3950 series supports IEEE802.1D spanning tree and IEEE802.1w rapid spanning tree. Spanning tree can effectively avoid loop, and at the same time, create a redundant backup for the link.

- **Port Mirroring**

The DCS-3950 series supports port mirroring, which can mirror the inbound/outbound traffic of one or more ports to another port, in order to detect relative information of data. This function can be used to debug network faults and monitor the network traffic.

- **DHCP Server, Client**

The DCS-3950 series supports DHCP server, which can dynamically allocate IP addresses for equipments, and bind MAC with IP by designating a specified IP for a specified MAC.

- **RADIUS**

The DCS-3950 series supports RADIUS (Remote Authentication Dial In User Service). RADIUS allows users to authenticate identity via IEEE802.1x protocol.

- **Complete Network Management**

The DCS-3950 series can do out-of-band and in-band management via Console, Telnet, Web and SNMP. Console and Telnet management support standard CLI(Command Line Interface), which makes the operation easier and faster, and also provide bilingual instructions in Chinese and English. Web management provides a remote browsing graphic management interface to make management more direct and convenient, to enable fast check of working state and to do real-time configuration management. SNMP management is in accordance with V1, V2C and V3 standard version, supporting Ether-Like MIB, Bridge MIB and MIB II, as well as standard management information libraries such as RMON 1/2/3/9 MIB II etc. The full SNMP network management can be realized via LinkManager, one China network managing software developed by the Digital China Limited. The DCS-3950 series also supports SSH protocol to farthest ensure the safety of configuration management. What's more, the DCS-3950 series provide an unique function to manage and set the IP of workstations, enabling the switch to automatically filter invalid remote network management access and guaranteeing the efficiency, security and coherence of remote network management access.

1.1.3 Main Features

- Applying Store-and-Forward switch mode to ensure block-free transmission.
- All of the RJ-45 ports support MDI/MDI-X self-adaptation can be conveniently cascade connected to other switch using straight-through twisted pair.
- Providing Console port.
- Allowing users to check the working state and statistic information of ports.
- Can be rebooted locally and remotely as well as reset the switch to the default configuration.
- Can update the firmware using TFTP/FTP.

- Can be fixed in a standard 19-inch frame.

1.2 Technical specifications

- **Protocols and Standards**
  - IEEE802.3 10BASE-T Ethernet
  - IEEE802.3u 100BASE-TX/FX Fast Ethernet
  - IEEE802.3x Flow control
  - IEEE802.1x access control
  - IEEE802.1d/w/s Spanning Tree
  - IEEE802.1p Class of Service
  - IEEE802.1q VLAN
  - IEEE802.3ad Link Aggregation
  - TFTP/FTP
  - DHCP
  - BootP
  - Telnet
  - IP/UDP/TCP/ICMP
  - HTTP
  - SNMP V1/V2c/V3

- **Management Standards and Methods**
  - CLI command line
  - SNMP V1/V2c/V3 enabled, available through Network management systems such as LinkManager
  - Web and Telnet management enable
  - RFC1757 RMON（1、2、3、9）

- **MIB**
  - RFC1213 MIB II
  - RFC1493 Bridge MIB
  - RFC1643 Ether-Like MIB
  - Private MIB
- **Management Protocols and Methods**
  - CLI command line
  - SNMP V1/V2C enabled, available through Network management systems such as LinkManager
  - Telnet management enabled
  - RFC1757 RMON（1, 2, 3, 9）
- **MIB Library**
  - RFC1213 MIB II
  - RFC1493 Bridge MIB

- RFC1643 Ether-Like MIB
- Digital -China Private MIB

1.3 Physical Specifications

	DCS-3950-26C/28CT/28C	DCS-3950-52CT/52C
weight	2.25KG	3KG
Dimension (mm)	440×171.2×43	440×229×44
Operating Temperature	0°C～50°C	
Storage Temperature	-40°C～70°C	
Relative humidity	10%～90%，with no condensate	
AC Power Input	100～240VAC，50～60Hz	
Power Consumption	30W Max	
Mean Time Between Failures	80,000 Hours	

Table1-1 DCS-3950 series switch physical specification

1.4 Product appearance

1.4.1 Product Front Panel View

DCS-3950 series switch front panel view as follows：

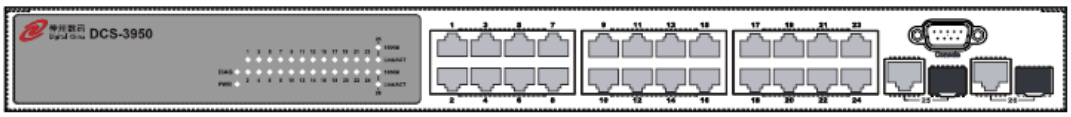


Fig 1-6 DCS-3950-26C switch front panel view

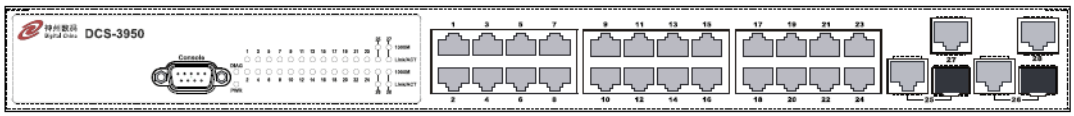


Fig 1-7 DCS-3950-28CT switch front panel view

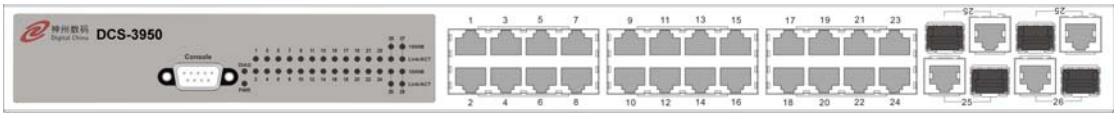


Fig 1-8 DCS-3950-28C switch front panel view

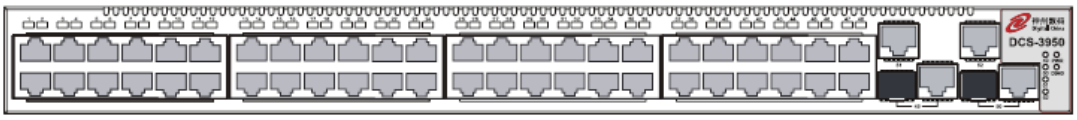


Fig 1-9 DCS-3950-52CT switch front panel view

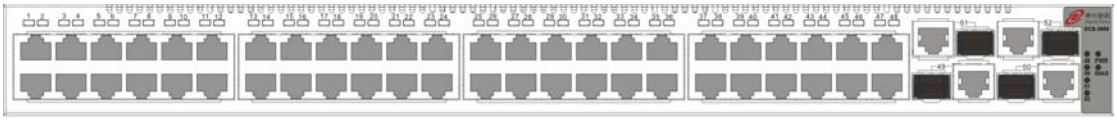


Fig 1-10 DCS-3950-52C switch front panel view

1.4.2 Product back panel view

DCS-3950 series back panel view as follows：

Fig 1-11 DCS-3950-26C/28CT/28C back panel view

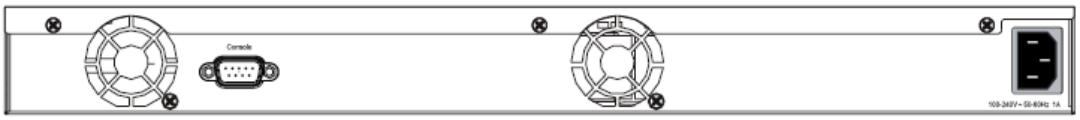


Fig 1-12 DCS-3950-52CT/52C back panel view

1.4.3 Status LEDs

The LEDs of DCS-3950 series switch include: PWR, DIAG, Link/Act and 1000M. Please refer to the following graph for meanings of the LED lights:

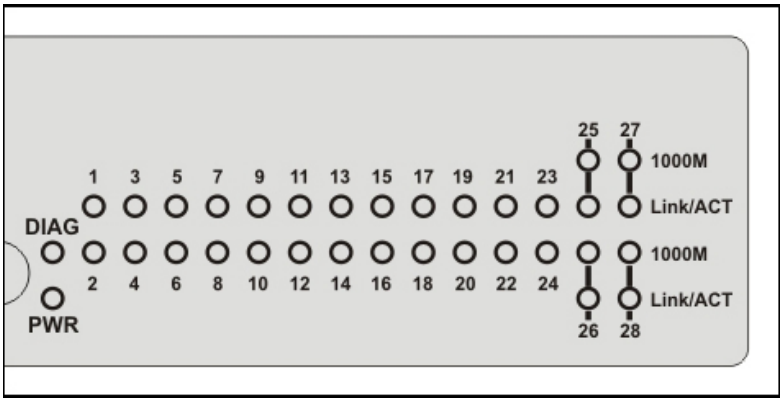


Fig 1-13 DCS-3950-26C/28CT/28C switch LED indicator lamp

Description of LEDs

LED	Sstate	Description
Link/ACT	Blink	The port is successfully linked and is sending /receiving data right now.
	Off	The state of the port is down.
	On	Link succeeds
1000M indicator lamp	On	The corresponding G port is in 1000M connecting mode.
	Off	The corresponding G port is in 100M connecting mode or in down state.
Power	On	Power on
	Off	Power off
DIAG	Green,blink	The program is initializing.
	On	The program has been initialized successfully.
	yellow,blink	The initialization of the program has failed.

Table1-2 Description of LEDs in DCS-3950-26C/28CT/28C Switch

DCS-3950-52CT/52C switch does not have the 1000M LED. The Link/ACT LED of its 100M port is above the corresponding port, while the Link/ACT LED of its 1000M port is on the right of the corresponding port.

Chapter 2 Hardware Installation

2.1 Installation Notice

To ensure the proper operation of DCS-3950 series and your physical security, please read carefully the following installation guide.

2.1.1 Environmental Requirements

- The switch must be installed in a clean area. Otherwise, the switch may be damaged by electrostatic adherence.
- Maintain the temperature within 0 to 50 °C and the humidity within 5% to 95%, non-condensing.
- The switch must be put in a dry and cool place. Leave sufficient spacing around the switch for good air circulation.
- The switch must work in the right range of power input AC power: 100 ~ 240VAC （50 ~ 60Hz）.
- The switch must be well grounded in order to avoid ESD damage and physical injury of people.
- The switch should avoid sunlight perpendicular incidence. Keep the switch away from heat sources and strong electromagnetic interference sources.
- The switch must be mounted to a standard 19'' rack or placed on a clean level desktop.

2.1.1.1 Dust and Particles

Dust is harmful to the safe operation of DCS-3950 series. Dust can lead to electrostatic adherence, especially likely under low relative humidity, causing poor contact of metal connectors or contacts. Electrostatic adherence will result in not only reduced product lifespan, but also increased chance of communication failures. The recommended value for dust content and particle diameter in the site is shown below:

Max Diameter (μm)	0.5	1	3	5
Max Density (particles/m³)	1.4×10^7	7×10^5	2.4×10^5	1.3×10^5

Table 2-1 Environmental Requirements: Dust

In addition, salt, acid and sulfide in the air are also harmful to the switch. Such harmful gases will aggravate metal corrosion and the aging of some parts. The site should avoid harmful gases, such as SO_2, H_2S, NO_2, NH_3 and Cl_2, etc. The table below details the

threshold value.

Gas	Average (mg/m³)	Max (mg/m³)
SO_2	0.2	1.5
H_2S	0.006	0.03
NO_2	0.04	0.15
NH_3	0.05	0.15
Cl_2	0.01	0.3

Table 2-2 Environmental Requirements: Particles

2.1.1.2 Temperature and Humidity

As the switch is designed to no fan, it's physical heat-away ,the site should still maintain a desirable temperature and humidity. High-humidity conditions can cause electrical resistance degradation or even electric leakage, degradation of mechanical properties and corrosion of internal components. Extreme low relative humidity may cause the insulation spacer to contract, making the fastening screw insecure. Furthermore, in dry environments, static electricity is liable to be produced and cause harm to internal circuits. Temperature extremes can cause reduced reliability and premature aging of insulation materials, thus reducing the switch's working lifespan. In the hot summer, it is recommended to use air-conditioners to cool down the site. And the cold winter, it is recommenced to use heaters.

The recommended temperature and humidity is shown below:

Temperature:		Relative humidity	
Long term condition	Short term condition	Long term condition	Short term condition
15 ~ 30°C	0 ~ 50°C	40 ~ 65%	10 ~ 95%

Table 2-3 Environmental Requirements: Temperature and Humidity

Caution!

A sample of ambient temperature and humidity should be taken at 1.5m above the floor and 0.4m in front of the switch rack, with no protective panel covering the front and rear of the rack.

Short term working conditions refer to a maximum of 48 hours of continued operation and an annual cumulative total of less than 15 days. Formidable operation conditions refers to the ambient temperature and relative humidity value that may occur during an air-conditioning system failure, and normal operation conditions should be recovered within 5 hours.

2.1.1.3 Power Supply

DCS-3950 series is designed to use modular switching power supplies. The power input specification is shown below:

Nominal Input Voltage: AC: 100 ~ 240 VAC,

Frequency: 50-60Hz

Total power consumption: ≤30W

Before powering on the power supply, please check the power input to ensure proper grounding of the power supply system. The input source for the switch should be reliable and secure; a voltage adaptor can be used if necessary. The building's circuit protection system should include in the circuit a fuse or circuit-breaker of no greater than 240 V, 10 A. It is recommended to use a UPS for more reliable power supplying

Caution!

Improper power supply system grounding, extreme fluctuation of the input source and transients (or spikes) can result in larger error rate, or even hardware damage!

2.1.1.4 Preventing Electrostatic Discharge Damage

Static electric discharges can cause damage to internal circuits, even the entire switch. Follow these guidelines for avoiding ESD damage

- Ensure proper earth grounding of the device
- Perform regular cleaning to reduce dust
- Maintain proper temperature and humidity
- Always wear an ESD wrist strap and antistatic uniform when in contact with circuit boards

2.1.1.5 Anti-interference

All sources of interference, whether from the device/system itself or the outside environment, will affect operations in various ways, such as capacitive coupling, inductive coupling, electromagnetic radiation, common impedance (including the grounding system) and cables/lines (power cables, signal lines, and output lines). The following should be noted:

- Precautions should be taken to prevent power source interference
- Provide the system with a dedicated grounding, rather than sharing the grounding with the electronic equipment or lightning protection devices
- Keep away from high power radio transmitters, radar transmitters, and high frequency strong circuit devices
- Provide electromagnetic shielding if necessary

2.1.1.6 Rack Configuration

The dimensions of the switch designed to be mounted on a standard 19'' rack, please ensure good ventilation for the rack

- Every device in the rack will generate heat during operation, therefore vent and fans must be provided for an enclosed rack, and devices should not be stacked closely.
- When mounting devices in an open rack, care should be taken to prevent the rack frame from obstructing the switch ventilation openings. Be sure to check the positioning of the switch after installation to avoid the aforementioned.

Caution!

If a standard 19'' rack is not available, the switch can be placed on a clean level desktop, leave a clearance of 10mm around the switch for ventilation, and do not place anything on top of the switch

---

2.1.2 Installation Notice

- Read through the installation instruction carefully before operating on the system. Make sure the installation materials and tools are prepared. And make sure the installation site is well prepared.
- During the installation, users must use the brackets and screws provided in the accessory kit. Users should use the proper tools to perform the installation. Users should always wear antistatic uniform and ESD wrist straps. Users should use standard cables and connecters.
- After the installation, users should clean the site. Before powering on the switch, users should ensure the switch is well grounded. Users should maintain the switch regularly to extend the lifespan of the switch.

2.1.3 Security Warnings

- Do not attempt to conduct the operations which can damage the switch or which can cause physical injury.
- Do not install, move or disclose the switch and its modules when the switch is in operation.
- Do not open the switch shell.
- Do not drop metals into the switch. It can cause short-circuit.
- Do not touch the power plug and power socket.
- Do not place the tinder near the switch.
- Do not configure the switch alone in a dangerous situation.
- Use standard power sockets which have overload and leakage protection.
- Inspect and maintain the site and the switch regularly.
- Have the emergence power switch on the site. In case of emergence, switch off the

power immediately.

WARNING:

Situations which are dangerous or harmful include but are not limited to the following items: creepage, over head power lines, broken down of power lines. If any emergency happens, please firstly cut down the power supply, and then dial the local emergency number.

2.2 Installation Preparation

2.2.1 Verify the Packet Contents

The above contents are subject to the received packet contents.

2.2.2 Required Tools and Utilities

The required tools and utilities	● Cross screwdrivers
	● Flat-blade screwdriver
	● wire clamp
	● Antistatic uniform
	● ESD wrist strap
	● Antistatic glove
Connecting cable	● Console cable and commutator
	● Standard Twisted-pair
	● RJ-45 pin

Table 2-4 The required tools and utilities

2.3 Hardware Installation

2.3.1 Installing the Switch

Please mount DCS-3950 series on the 19’’ rack as below

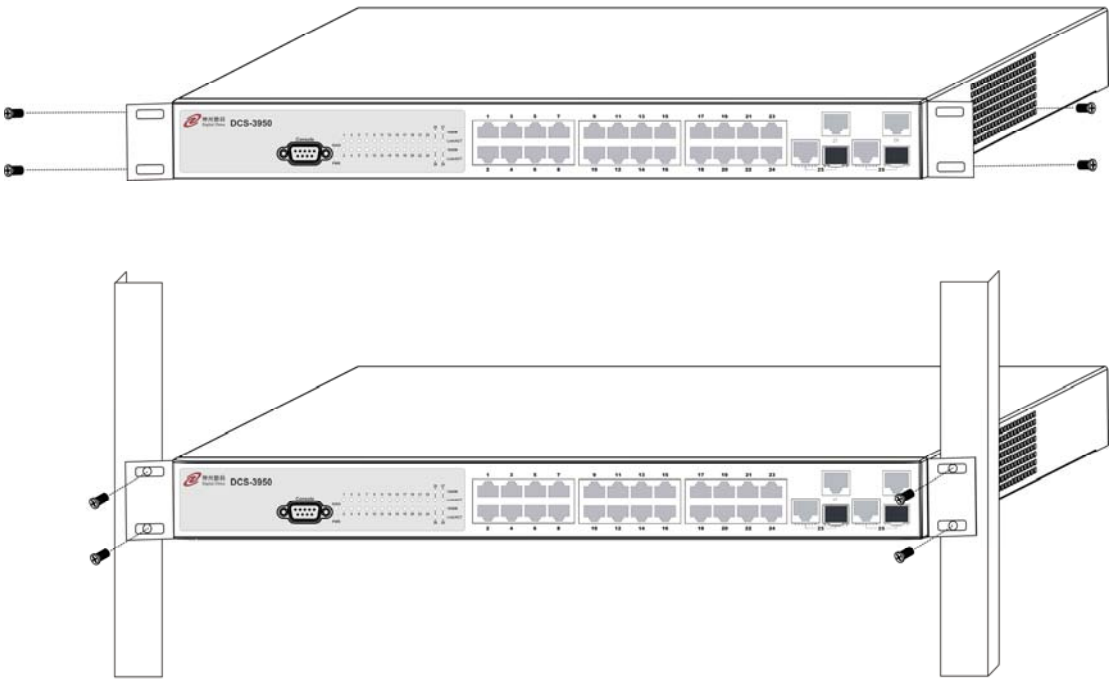


Fig 2-1 DCS-3950 series Rack-mounting

1. Attach the 2 brackets on the DCS-3950 series with screws provided in the accessory kit.
2. Put the bracket-mounted switch smoothly into a standard 19'' rack. Fasten the DCS-3950 series to the rack with the screws provided. Leave enough space around the switch for good air circulation.

Caution!

The brackets are used to fix the switch on the rack. They can't serve as a bearing. Please place a rack shelf under the switch. Do not place anything on top of the switch. Do not block the blowholes on the switch to ensure the proper operation of the switch.

2.3.2 Connecting Console

DCS-3950 series provides a DB9 interface serial console port. The connection procedure is listed below

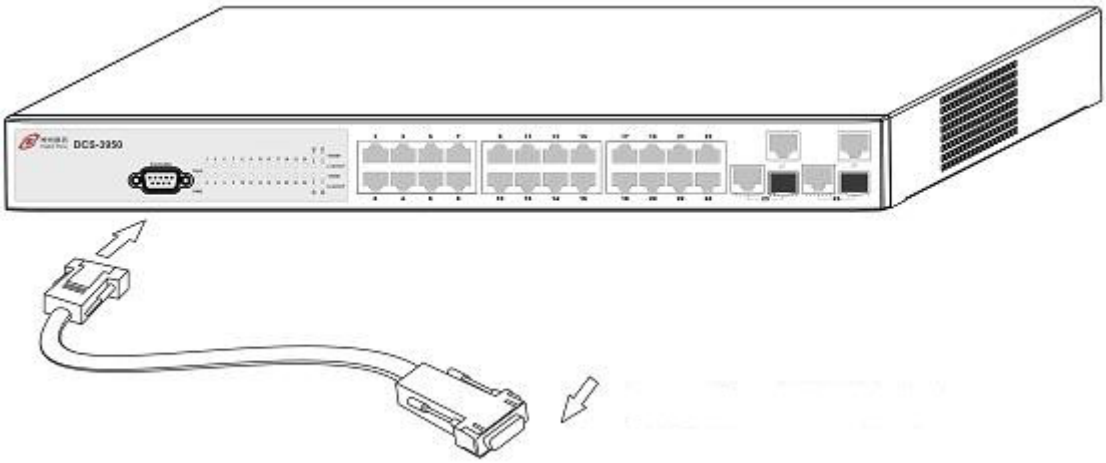


Fig 2-2 Connecting Console to DCS-3950 series

1. Please attach the console cable which is contained in the accessory kit to the Console port of the switch.
2. Connect the other side of the console cable to a character terminal (PC).
3. Power on the switch and the character terminal. Configure the switch through the character terminal.

Caution!

Please use the console cable and the console commutator of the switch. Don't insert in error to avoid break.

2.3.3 Power Supply Connection

DCS-3950 series uses 100～240VAC,50～60Hz supply by default. AC Power supply connection procedure is described as below:

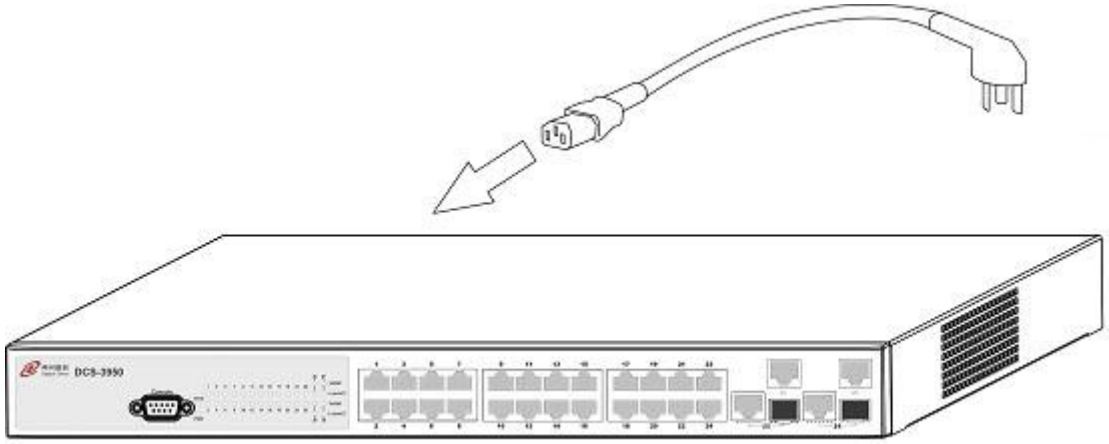


Fig 2-3 Attaching power cable to DCS-3950 series

1. Insert one end of the power cable provided in the accessory kit into the power source socket (with overload and leakage protection), and the other end to the power socket in the back panel of the switch.
2. Check the power status indicator in the front panel of the switch. The corresponding power indicator should light. DCS-3950 series is self-adjustable for the input voltage. As soon as the input voltage is in the range printed on the switch surface, the switch can operate correctly.
3. When the switch is powered on, it executes self-test procedure and startups.

Caution!

The input voltage must be within the required range, otherwise the switch could malfunction of be damaged. Do not open the switch shell without permission. It can cause physical injury

---

Chapter 3 Setup Configuration

Setup configuration refers to the initial operation to the switch after the user purchases the switch. For first-time users of the DCS-3950 series, this chapter provides a very practical instruction. When using the CLI (command line interface), the user can type *setup* under admin mode to enter the Setup configuration interface.

3.1 Setup Configuration

Setup configuration is done via menu selections, in which switch hostname, Vlan1 interface, Telnet service, Web service, and SNMP, can be configured.

3.2 Main Setup Menu

Before entry into the main menu, the following screen will be displayed to prompt the user to select a preferred interface language. English users should choose '0' to enter the English interface, while Chinese users can choose '1' to view the interface in Chinese.

Please select language
[0]: English
[1]: Chinese
Selection (0|1)[0]:

The main Setup configuration menu is listed below:

Configure menu
[0]: Config hostname
[1]: Config interface-Vlan1
[2]: Config telenet-server
[3]: Config web-server
[4]: Config SNMP
[5]: Exit setup configuration without saving
[6]: Exit setup configuration after saving
Selection number:

3.3 Setup Submenu

3.3.1 Configuring switch hostname

Select '0' in the Setup main menu and press Enter, the following screen appears:

Please input the host name [switch]:

Note: the hostname entered should be less than 30 characters. If the user presses

Enter without input, the hostname will default to ‘switch’

3.3.2 Configuring Vlan1 Interface

Select ‘1’ in the Setup main menu and press Enter to start configuring the Vlan1 interface

Config Interface-Vlan1
[0]: Config interface-Vlan1 IP address
[1]: Config interface-Vlan1 status
[2]: Exit
Selection number:

Select ‘0’ in the Vlan1 interface configuration menu and press Enter, the following screen appears

Please input interface-Vlan1 IP address (A.B.C.D):

When the user enters valid IP address for Vlan1 interface and presses Enter, the following screen will appear:

Please input interface-Vlan1 mask [255.255.255.0]:

Select ‘1’ in the Vlan1 interface configuration menu and press Enter, the following screen will appear:

Open interface-Vlan1 for remote configuration ? (y/n) [y]:

When the switch is booted for the first time, the Vlan1 interface is disabled by default. In order to enable the vlan1 interface, ‘y’ or ENTER should be entered.

Select ‘2’ in the Vlan1 interface configuration menu will return to the Setup main menu.

3.3.3 Telnet Server Configuration

Select ‘2’ in the Setup main menu and press Enter to start configuring the Telnet server, the follow appears:

Configure telnet server
[0]: Add telnet user
[1]: Config telnet server status
[2]: Exit
Selection number:

Select ‘0’ in the Telnet server configuration menu and press Enter, the following screen appears:

Please input the new telnet user name:

Note: the valid username length is 1 to 16 characters. When the user enters a valid username and presses Enter, the following screen appears

Please input the new telnet user password:

Notice: The valid length for the password should be between 1 and 8 characters. After user name and password are configured correctly, system configuration shell will be prompted.

Select ‘1’ in the Telnet server configuration menu and press Enter, the following screen appears:

Enable switch telnet-server or no? (y/n) [y]:

Type ‘y’ and press Enter, or just press Enter to enable Telnet service, type ‘n’ and press Enter to disable Telnet service. The Telnet server configuration menu appears.

Select ‘2’ in the Telnet server configuration menu will return to the Setup main menu.

3.3.4 Configuring Web Server

Select ‘3’ in the Setup main menu and press Enter to start configuring the Web server, the follow appears:

Configure web server

[0]: Add webuser

[1]: Config web server status

[2]: Exit

Selection number:

Select ‘0’ in the Web server configuration menu and press Enter, the following screen appears:

Please input the new web user name:

Note: the valid username length is 1 to 16 characters. When the user enters a valid username and presses Enter, the following screen appears

Please input the new web user password:

Note: the valid password length is 1 to 8 characters. After configuring the username and password, the menu will return to the Web server configuration section

Select ‘1’ in the Web server configuration menu and press Enter, the following screen appears:

Enable switch web-server or no?(y/n) [y]:

Type ‘y’ and press Enter, or just press Enter to enable Web service, type ‘n’ and press Enter to disable Web service. The Web server configuration menu appears.

Select ‘2’ in the Telnet server configuration menu will return to the Setup main menu.

3.3.5 Configuring SNMP

Select ‘4’ in the Setup main menu and press Enter to start configuring SNMP, the following appears

Configure SNMP
[0]: Config SNMP-server read-write community string
[1]: Config SNMP-server read-only community string
[2]: Config traps-host and community string
[3]: Config SNMP-server status
[4]: Config SNMP traps status
[5]: Add SNMP NMS security IP address
[6]: Exit
Selection number:

Select ‘0’ in SNMP configuration menu and press Enter, the following screen appears:
Please input the read-write access community string[private]:

Note: the valid length for a read-write access community string is 1 to 255 characters; the default value is ‘private’. When a valid read-write access community string is entered, pressing Enter returns you to the SNMP configuration menu.

Select ‘1’ in the SNMP configuration menu and press Enter, the following screen will appear:
Please input the read-only access community string[public]:
Note: the valid length for a read-only access community string is 1 to 255 characters; the default value is ‘public’. When a valid read-only access community string is entered, press ***Enter*** returns to the SNMP configuration menu.

Select ‘2’ in the SNMP configuration menu and press Enter, the following screen will appear:

Please input traps-host IP address (A.B.C.D):
When the user enters a valid IP address for Traps host and presses Enter, the following appears:
Please input traps community string[public]:
Note: the valid length for a traps community string is 1 to 255 characters, the default value is ‘public’. When a valid traps community string is entered, press Enter returns to the SNMP configuration menu.

Select ‘3’ in the SNMP configuration menu and press Enter, the following screen will appear:

Enable SNMP-server? (y/n) [y]:

Type ‘y’ and press Enter, or just press Enter to enable SNMP service, type ‘n’ and press Enter to disable SNMP service. The SNMP configuration menu appears.

Select ‘4’ in the SNMP configuration menu and press Enter, the following screen will appear:

Enable SNMP-traps ? (y/n) [y]:

Type ‘y’ and press Enter, or just press Enter to enable SNMP Traps, type ‘n’ and press Enter to disable SNMP traps. The SNMP configuration menu appears.

Select ‘5’ in the SNMP configuration menu and press Enter, the following screen appears:

Please input the new NMS IP address (A.B.C.D):

When a valid secure IP address (es) for SNMP management workstation is entered, press Enter to return to the SNMP configuration menu.

Selecting ‘6’ in the SNMP configuration menu will return to the Setup main menu.

3.3.6 Exiting Setup Configuration Mode

Select ‘5’ in the Setup main menu to exit the Setup configuration mode without saving the configurations made.

Selecting ‘6’ in the Setup main menu exits the Setup configuration mode and saves the configurations made. This is equivalent to running the *Write* command. For instance, if under the Setup configuration mode, the user sets a Telnet user and enables Telnet service, and selects ‘5’ to exit Setup main menu. User will be able to configure the switch through Telnet from a terminal.

When exiting the Setup configuration mode, the CLI configuration interface appears. Configuration commands and syntaxes will be described in detail in later chapters.

Chapter 4 Switch Management

4.1 Management Options

After purchasing the switch, the user needs to configure the switch for network management. DCS-3950 series provides two management options: in-band management and out-of-band management.

4.1.1 Out-of-band Management

Out-of-band management is the management through Console interface. Generally, the user will use out-of-band management for the initial switch configuration, or when in-band management is not available. For instance, the user must assign an IP address to the switch via the Console interface to be able to access the switch through Telnet.

The procedures for management via Console interface are listed below:

Step 1: setting up the environment:

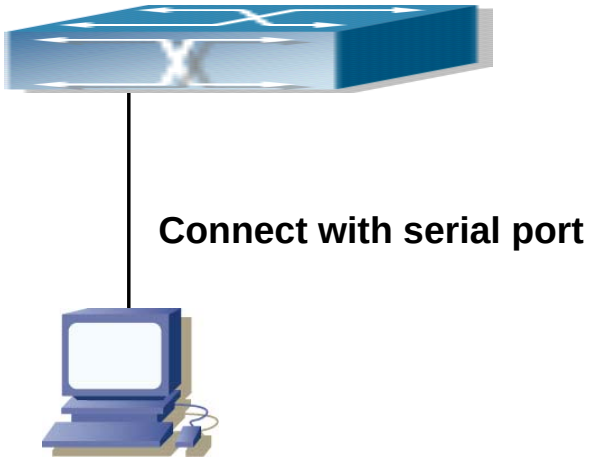


Fig 4-1 Out-of-band Management Configuration Environment

The serial port (RS-232) is connected to the switch with the serial cable provided. The table below lists all the devices used in the connection.

Device Name	Description
PC machine	Has functional keyboard and RS-232, with terminal emulator installed, such as the HyperTerminal included in Windows 9x/NT/2000/XP.
Serial port cable	One end attach to the RS-232 serial port, the other end to the Console port of DCS-3950 series.
DCS-3950	Functional Console port required.

Step 2 Entering HyperTerminal.

Open the HyperTerminal included in Windows after the connection established.

1) Click Start menu - All Programs – Accessories – Communication - HyperTerminal.

2）Type a name for opening HyperTerminal, such as ‘Switch_A’.

Fig 4-2 Opening HyperTerminal

3）In the ‘Connecting with’ drop-list, select the RS-232 serial port used by the PC, e.g. COM1, and click ‘OK’.

Fig 4-3 Opening HyperTerminal

4）COM1 property appears, select ‘9600’ for ‘Baud rate’, ‘8’ for ‘Data bits’, ‘none’ for ‘Parity

checksum', '1' for stop bit and 'none' for traffic control; or, you can also click 'Revert to default' and click 'OK'.

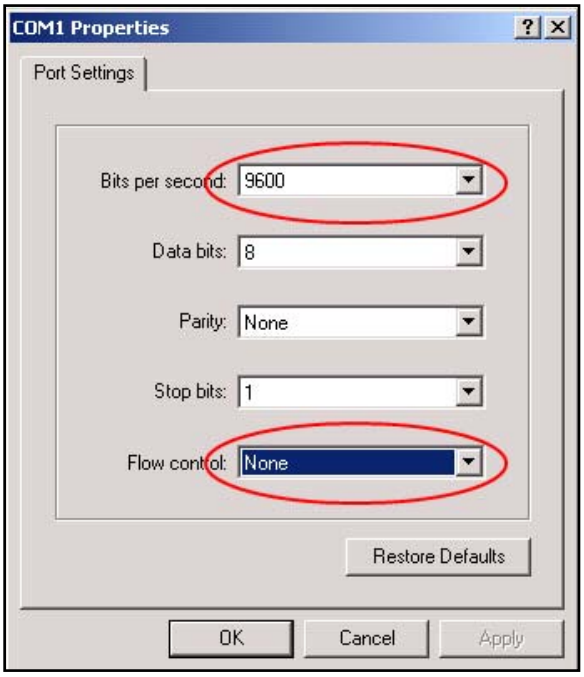


Fig 4-4 Opening HyperTerminal

Step 3 Entering switch CLI interface:

Power on the switch. The following appears in the HyperTerminal windows, that is the CLI configuration mode for

Testing RAM...

67,108,864 RAM OK.

Initializing...

Booting.....
Starting at 0x10000...

Current time is MON JAN 01 00:00:00 2001

DCS-3950-28C Series Switch Operating System
SoftWare Version DCRS-5200-28_1.2.17.0
DCNOS Version DCNOS_5.1.35.47
Copyright (C) 2001-2007 Digital China Networks Limited
http://www.dcnetworks.com.cn

DCS-3950-28C Switch (88E6218-133M) processor
28 Ethernet/IEEE 802.3 interface(s)

Switch>

The user can now enter commands to manage the switch. For a detailed description for the commands, please refer to the following chapters.

4.1.2 In-band Management

In-band management refers to the management by logging into the switch using Telnet. In-band management enables the function of managing the switch for some devices attached to the switch. In the case when in-band management fails due to switch configuration changes, out-of-band management can be used for configuring and managing the switch.

4.1.2.1 Management via Telnet

To manage the switch with Telnet, the following conditions should be met:

1) Switch has an IP address configured;
2) The host IP address (Telnet client) and the switch's VLAN interface IP address is in the same network segment.
3) If not 2), Telnet client can connect to an IP address of the switch via other devices, such as a router.

DCS-3950 series are Layer 2 switch that can be configured with several IP addresses. The following example assumes the shipment status of the switch, where only VLAN1 exists in the system.

The following describes the steps for a Telnet client to connect to the switch's VLAN1 interface by Telnet.

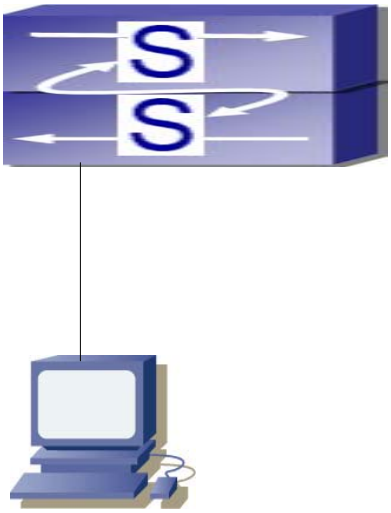


Fig 4-5 Manage the switch by Telnet

Step 1: Configure the IP addresses for the switch

First is the configuration of host IP address, which should be within the same network segment as the switch VLAN1 interface IP address. Suppose the switch VLAN interface IP address 10.1.128.251/24, and then a possible host IP address is 10.1.128.25/24. Run 'ping 10.1.128.251' from the host and verify the result, check for reasons if ping fails.

The IP address configuration commands for VLAN1 interface DCS-3950 series are listed below. Before in-band management, the switch must be configured with an IP address by out-of-band management (i.e. Console mode), The configuration commands (All switch configuration prompts are assumed to be 'switch' hereafter if not otherwise specified):

```
Switch>
Switch>en
Switch#config
Switch(Config)#interface vlan 1
Switch(Config-If-Vlan1)#ip address 10.1.128.251 255.255.255.0
Switch(Config-If-Vlan1)#no shutdown
```

Step 2: Run Telnet Client program

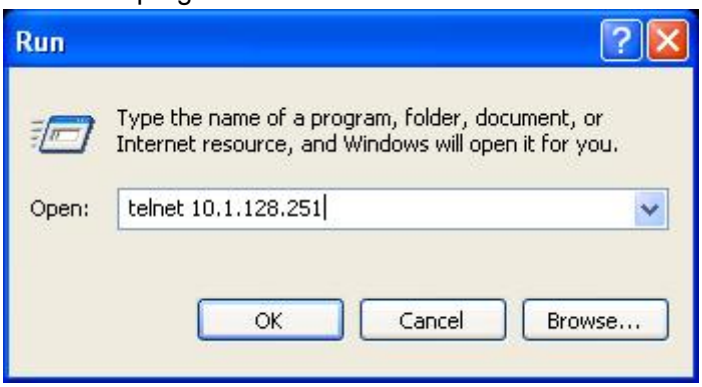


Fig 4-6 Run telnet client program included in Windows

Run Telnet client program included in Windows with the specified Telnet target

Step 3: Login to the switch

Login in to the Telnet configuration interface. Valid login name and password is required, otherwise the switch will reject Telnet access. This is a method to protect the switch from unauthorized access. If no authorized Telnet user has been configured, nobody can connect to the Telnet CLI configuration interface. As a result, when Telnet is enabled for configuring and managing the switch, username and password for authorized Telnet users must be configured with the following command:

telnet-user <user> password {0|7} <password>

Assume a authorized user in the switch has a username of ‘test’, and password of ‘test’, the configuration procedure should be like the following:

Switch>en
Switch#config
Switch(Config)#telnet-user test password 0 test

Enter valid login name and password in the Telnet configuration interface, Telnet user will be able to enter the switch’s CLI configuration interface. The commands used in the Telnet CLI interface after login are the same as in that in the Console interface.

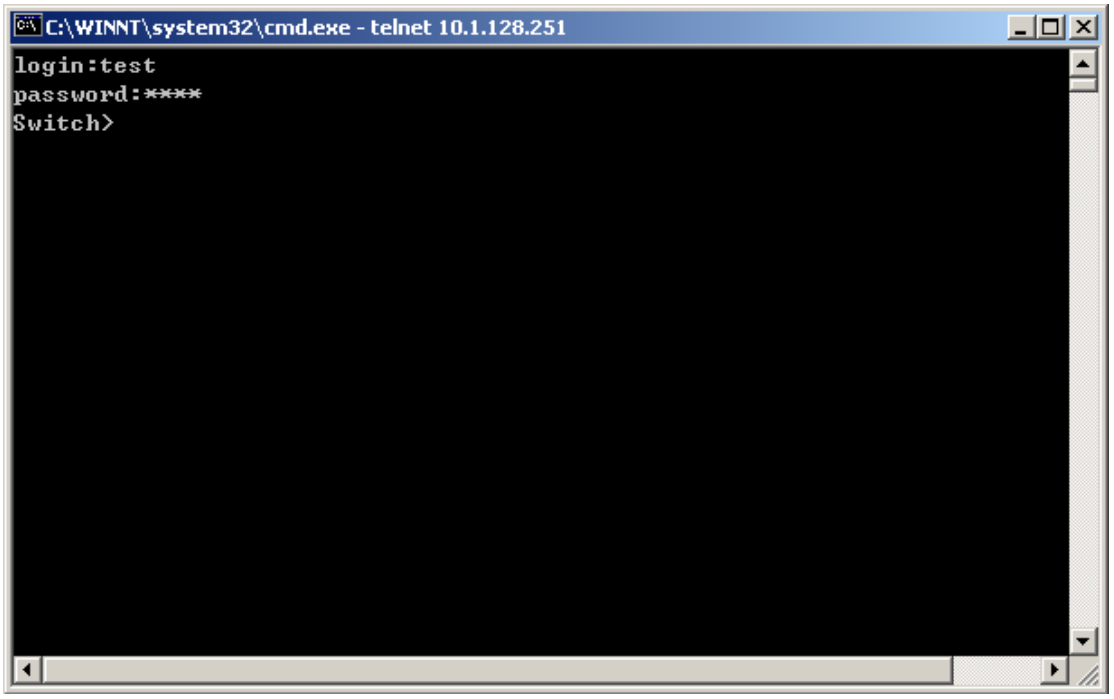


Fig 4-7 Telnet Configuration Interface

4.1.2.2 Management via HTTP

To manage the switch via HTTP, the following conditions should be meet:

1) Switch has an IP address configured;
2) The host IP address and the switch’s VLAN interface IP address is in the same network segment.
3) If not 2), Telnet client can connect to an IP address of the switch via other devices, such as a router.

Similar to management via Telnet, as soon as the host succeeds to ping an IP address of the switch and to type the right login password, it can access the switch via HTTP. The configuration list is as below:

Step 1: Configure the IP addresses for the switch and start the HTTP function on the switch.

For configuring the IP address on the switch through out-of-band management, see

the relevant chapter.

To enable the WEB configuration, users should type the CLI command **ip http server** in the global mode as below:

Switch>en
Switch#config
Switch(Config)#ip http server

Step 2: Run HTTP protocol on the host.

Open the Web browser on the host and type the IP address of the switch. Or run directly the HTTP protocol on the Windows. For example, the IP address of the switch is '10.1.128.251'.

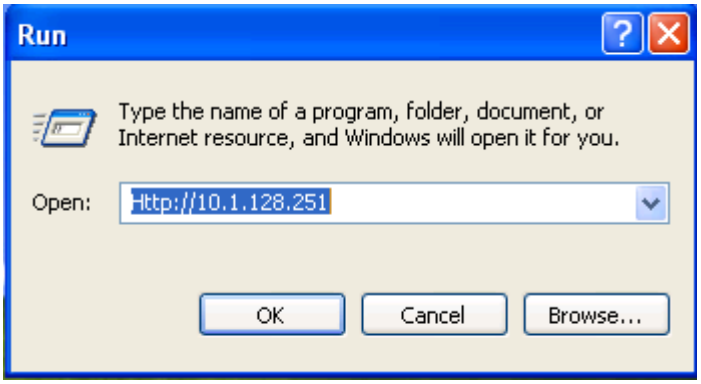


Fig 4-8 Run HTTP Protocol

Step 3: Logon to the switch

To logon to the HTTP configuration interface, valid login user name and password are required; otherwise the switch will reject HTTP access. This is a method to protect the switch from the unauthorized access. Consequently, in order to configure the switch via HTTP, username and password for authorized HTTP users must be configured with the following command in the global mode: **web-user <*user*> password {0|7} <*password*>** Suppose an authorized user in the switch has a username as 'test', and password as 'test'. The configuration procedure is as below:

Switch>en
Switch#config
Switch(Config)#web-user admin password 0 digital
Input the right username and password, and then the main Web configuration interface.

4.1.2.3 Management via LinkManager

To manage the switch with LinkManager, the following conditions should be met:

1) Switch has an IP address configured
2) The host IP address (LinkManager) and the switch's VLAN interface IP address is in the same network segment.
3) If not 2), LinkManager can connect to an IP address of the switch via other devices, such as a router.

Management via LinkManager, the host succeeds to ping an IP address of the switch, then run the switch, LinkManager network management software will be found by DCS-3950 series,and operate it with read-write permission ,For more details on how to configure the switch through LinkManager, please refer to the LinkManager Manual.

4.2 Management Interface

DCS-3950 series provide three management interfaces: CLI（Command Line Interface）, Web interface, LinkManager network management software。Details about CLI interface and Web interface will be presented as below. And for anything about LinkManager, please refer to the LinkManager Manual.

4.2.1 CLI Interface

CLI interface is familiar to most users. As aforementioned, both out-of-band management and Telnet login are all performed through CLI interface to manage the switch.

CLI Interface is supported by Shell program, which consists of a set of configuration commands. Those commands are categorized according to their functions in switch configuration and management. Each category represents a different configuration mode. The Shell for the switch is described below:

- Configuration Modes
- Configuration Syntax
- Shortcut keys
- Help function
- Input verification
- Fuzzy match support

4.2.1.1 Configuration Modes

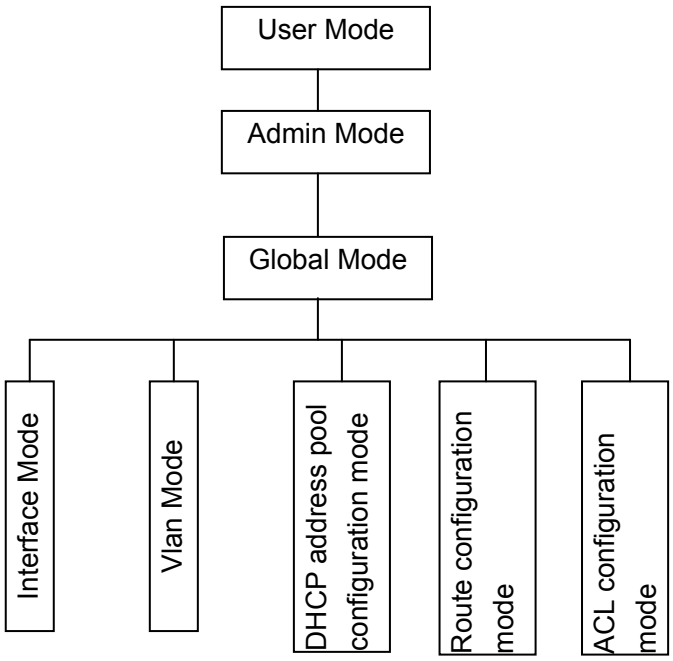


Fig 4-9 Shell Configuration Modes of DCS-3950 series

4.2.1.1.1 User Mode

On entering the CLI interface, entering user entry system first. If as common user, it is defaulted to User Mode. The prompt shown is '**Switch**>', the symbol '>' is the prompt for User Mode. When **exit** command is exit under Admin Mode, it will also return to the User Mode.

Under User Mode, no configuration to the switch is allowed, only clock time and version information of the switch can be queries.

4.2.1.1.2 Admin Mode

When **enable** command is used under User Mode,To Admin Mode sees the following: In user entry system, if as Admin user, it is defaulted to Admin Mode. Admin Mode prompt '**Switch#**' can be entered under the User Mode by running the *enable* command and entering corresponding access levels admin user password, if a password has been set. Or, when ***exit*** command is run under Global Mode, it will also return to the Admin Mode. DCS-3950 series Switch also provides a shortcut key sequence 'Ctrl+z', this allows an easy way to exit to Admin Mode from any configuration mode (except User Mode).

Under Admin Mode, the user can query the switch configuration information, connection status and traffic statistics of all ports; and the user can further enter the Global Mode from Admin Mode to modify all configurations of the switch. For this reason, a password must be set for entering Admin mode to prevent unauthorized access and malicious modification to the switch.

4.2.1.1.3 Global Mode

Type the config **command** under Admin Mode will enter the Global Mode prompt '**Switch(Config)#**'. Use the **exit** command under other configuration modes such as Interface Mode, VLAN mode will return to Global Mode.

The user can perform global configuration settings under Global Mode, such as MAC Table, Port Mirroring, VLAN creation, IGMP Snooping start, GVRP and STP, etc. And the user can go further to Interface Mode for configuration of all the interfaces.

4.2.1.1.4 Interface Mode

Use the ***interface*** command under Global Mode can enter the interface mode specified. DCS-3950 series Switch provides three interface type: VLAN interface, Ethernet port and port-channel, and accordingly the three interface configuration modes.

Interface Type	**Entry**	**Prompt**	**Operates**	**Exit**
VLAN Interface	Type **interface vlan <Vlan-id>** command under Global Mode.	**Switch(Config-If-Vlanx)#**	Configure switch IPs, etc	Use the **exit** command to return to Global Mode.
Ethernet Port	Type **interface ethernet <interface-list>** command under Global Mode.	**Switch(Config-ethernetxx)#**	Configure supported duplex mode, speed, etc. of Ethernet Port.	Use the **exit** command to return to Global Mode.

port-channel	Type **interface port-channel <port-channel-number>** command under Global Mode.	**Switch(Config-if-port-channelx)#**	Configure port-channel related settings such as duplex mode, speed, etc.	Use the **exit** command to return to Global Mode.

4.2.1.1.5 VLAN Mode

Using the ***vlan*** **<vlan-id>** command under Global Mode can enter the corresponding VLAN Mode. Under VLAN Mode the user can configure all member ports of the corresponding VLAN. Run the exit command to **exit** the VLAN Mode to Global Mode

4.2.1.1.6 DHCP Address Pool Mode

Type the **ip dhcp pool <*name*>** command under Global Mode will enter the DHCP Address Pool Mode prompt '**Switch(Config-<name>-dhcp)#**'. DHCP address pool properties can be configured under DHCP Address Pool Mode. Run the **exit** command to exit the DHCP Address Pool Mode to Global Mode.

4.2.1.1.7 ACL Mode

ACL type	Entry	Prompt	Operates	Exit
Standard IP ACL Mode	Type **ip access-list standard** command under Global Mode.	**Switch(Config-Std-Nacl-a)#**	Configure parameters for Standard IP ACL Mode	Use the '*exit*' command to return to Global Mode.
Extended IP ACL Mode	Type **ip access-list extanded** command under Global Mode.	**Switch(Config-Ext-Nacl-b)#**	Configure parameters for Extended IP ACL Mode	Use the '*exit*' command to return to Global Mode.

4.2.1.2 Configuration Syntax

DCS-3950 series Switch provides various configuration commands. Although all the commands are different, they all abide by the syntax for DCS-3950 series Switch configuration commands. The general commands format of DCS-3950 series Switch is

shown below:

cmdtxt <*variable*> { enum1 | … | enumN } [option]

Conventions: **cmdtxt** in bold font indicates a command keyword; ***<variable>*** indicates a variable parameter; **{enum1 | … | enumN }** indicates a mandatory parameter that should be selected from the parameter set **enum1~enumN**; and the square bracket ([ ]) in **[option]** indicate an optional parameter. There may be combinations of '< >', '{ }' and '[ ]' in the command line, such as **[<*variable*>]**,**{enum1 <*variable*>| enum2}**, **[option1 [option2]], etc.**

Here are examples for some actual configuration commands:

- **show version**， no parameters required. This is a command with only a keyword and no parameter, just type in the command to run.
- **vlan <*vlan-id*>**， parameter values are required after the keyword.
- **speed-duplex {auto | force10-half | force10-full | force100-half | force100-full | {{force1g-half | force1g-full} [nonegotiate [master | slave]] } }**，the followings are possible:
  speed-duplex auto
  speed-duplex force10-half
  speed-duplex force10-full
  speed-duplex force100-half
  speed-duplex force100-full
  speed-duplex force1g-half
  speed-duplex force1g-half nonegotiate
  speed-duplex force1g-half nonegotiate master
  speed-duplex force1g-half nonegotiate slave
  speed-duplex force1g-full
  speed-duplex force1g-full nonegotiate
  speed-duplex force1g-full nonegotiate master
  speed-duplex force1g-full nonegotiate slave

- **snmp-server community {ro|rw} <*string*>**， command options are presented as below:
  snmp-server community ro <*string*>
  snmp-server community rw <*string*>

4.2.1.3 Shortcut Key Support

DCS-3950 series switch provides several shortcut keys to facilitate user configuration, such as up, down, left, right and Blank Space. If the terminal does not recognize Up and Down keys, ctrl +p and ctrl +n can be used instead.

Key(s)	Function

Back Space	Delete a character before the cursor, and the cursor moves back.	
Up '↑'	Show previous command entered. Up to ten recently entered commands can be shown.	
Down '↓'	Show next command entered. When use the Up key to get previously entered commands, you can use the Down key to return to the next command	
Left '←'	The cursor moves one character to the left.	You can use the Left and Right key to modify an entered command.
Right '→'	The cursor moves one character to the right.	
Ctrl +p	The same as Up key '↑'.	
Ctrl +n	The same as Down key '↓'.	
Ctrl +b	The same as Left key '←'.	
Ctrl +f	The same as Right key '→'.	
Ctrl +z	Return to the Admin Mode directly from the other configuration modes (except User Mode).	
Ctrl +c	Break the ongoing command process, such as ping or other command execution.	
Tab	When a string for a command or keyword is entered, the Tab can be used to complete the command or keyword if there is no conflict.	
/	Perform command of previous list,such as perform show command of admin mode under config mode: Switch(Config)#/show run	
//	Perform command of previous list,such as perform show command of admin mode under port config:Switch(Config-Port-Range)#//show clock.	

4.2.1.4 Help Function

There are two ways in DCS-3950 series Switch for the user to access help information: the 'help' command and the '?'.

Access to Help	**Usage and function**
Help	Under any command line prompt, type in 'help' and press Enter will get a brief description of the associated help system.
'?'	1.Under any command line prompt, enter '?' to get a command list of the current mode and related brief description. 2.Enter a '?' after the command keyword with a embedded space. If the position should be a parameter, a description of that parameter type, scope, etc, will be returned; if the position should be a keyword, then a set of keywords with brief description will be returned; if the output is '<cr>', then the command is complete, press Enter to run the

	command. 3.A '?' immediately following a string. This will display all the commands that begin with that string.

4.2.1.5 Input Verification

4.2.1.5.1 Returned Information: success

All commands entered through keyboards undergo syntax check by the Shell. Nothing will be returned if the user entered a correct command under corresponding modes and the execution is successful.

4.2.1.5.2 Returned Information: error

Returned Information: error

Output error message	Explanation
Unrecognized command or illegal parameter!	The entered command does not exist, or there is error in parameter scope, type or format.
Ambiguous command	At least two interpretations is possible basing on the current input.
Invalid command or parameter	The command is recognized, but no valid parameter record is found.
This command is not exist in current mode	The command is recognized, but this command can not be used under current mode.
Please configure precursor command '*' at first !	The command is recognized, but the prerequisite command has not been configured.
syntax error : missing '" before the end of command line!	Quotation marks are not used in pairs.

4.2.1.6 Fuzzy Match Support

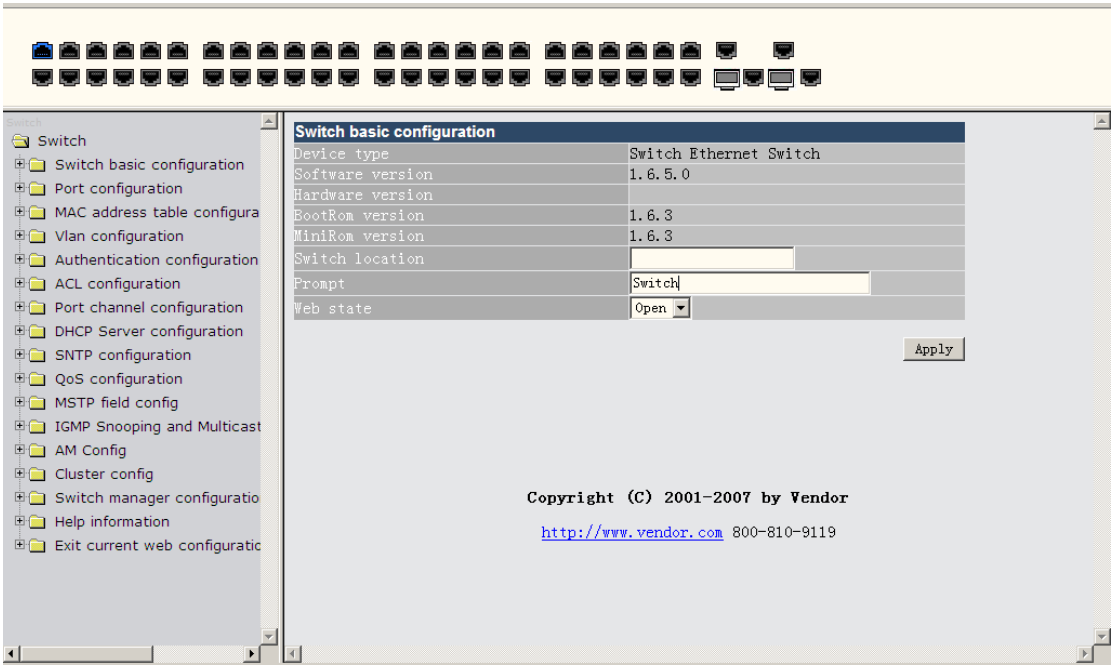
DCS-3950 series switch shell support fuzzy match in searching command and keyword. Shell will recognize commands or keywords correctly if the entered string causes no conflict.

For example:

1. For command 'show interfaces status ethernet 1', typing 'sh in e 1' will work
2. However, for command 'show running-config', the system will report a '> Ambiguous

command!' error if only 'sh r' is entered, as Shell is unable to tell whether it is 'show r' or 'show running-config'. Therefore, Shell will only recognize the command if 'sh ru' is entered.

4.2.2 Web Interface



The Web configuration interface has three parts: the upper part, the bottom left part and the bottom right part.

The upper part is a picture of the front panel of a DCS-3950 series switch, which can show the connection state of each port via the LEDs on the panel. If users click the port on the picture of the front panel, the statistic traffic information of each port will be displayed at the bottom right part of the Web configuration interface.

The bottom left part of the Web configuration interface is the main menu, with which users can configure, control and maintain the switch, monitor ports and so on. The bottom right part is used to display information and to interact with users. When the users click the upper part or the bottom left part, the bottom right part will show the configuration interface of the corresponding menu(submenu), then, the users can configure the switch as they want to. To know more about the parameters appeared in the configuration interface, please refer to the configuration introduction in relative chapters.

Tips on using the Web Configuration Interface

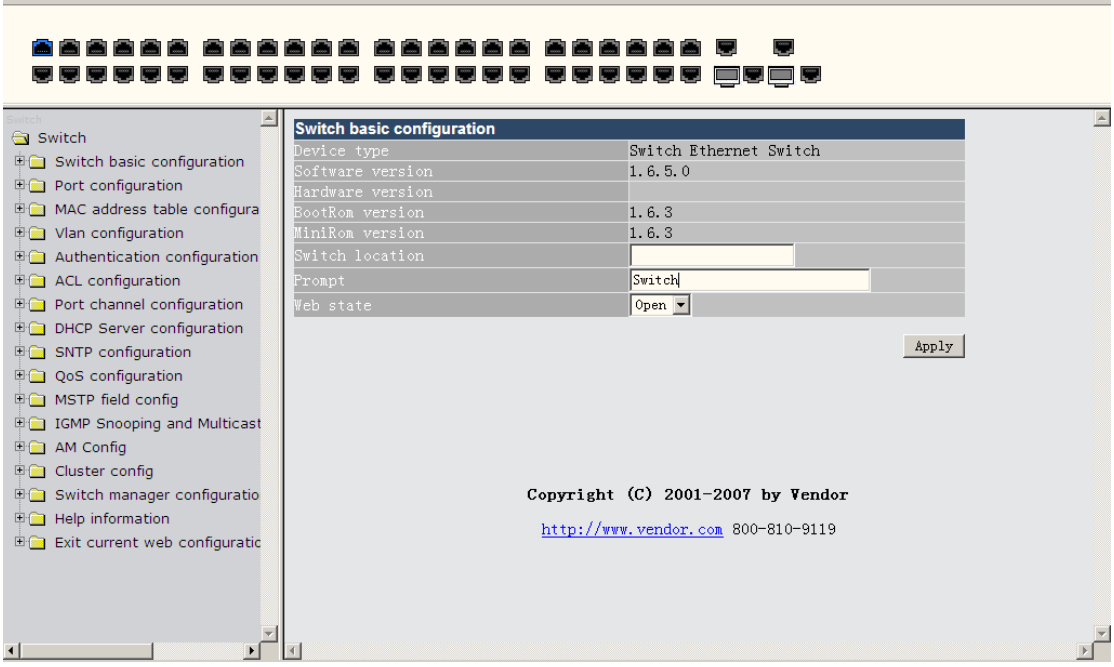
Tip 1

IE6.0 or later/800*600 is recommened, and JavaScript is required to be enabled.

Tip 2

To guarantee the validity of the operation of CGI programs, the brower is required to read

new stuff from the server every time instead of the system cache. The following steps will show you how to realize this: Choose the Tools(T)->Internet Options from the menu of a Website or right click the IE browser on the desktop and choose Properities to enter the configuration interface. In the ‘Settings’ dialog box of ‘Temporary Internet File’, under ‘Check for newer versions of stored pages’, click ‘Every visit to the page’.



Chapter 5 Basic Switch Configuration

5.1 Basic Switch Configuration Command List

Basic switch configuration includes commands for entering and exiting the admin mode, commands for entering and exiting interface mode, for configuring and displaying the switch clock, for displaying the version information of the switch system, etc.

Caution!
By default, the host name of a switch and the command line prompt is the same as the type of the switch. In this chapter, “Switch” is used to represent general command line prompt.

5.1.1 clock set

Command: clock set <*HH:MM:SS*> <*YYYY/MM/DD*>
Function: Configure data and time setting
Parameter: <*HH:MM:SS* >current time,***HH:*** The number range 0~23, ***MM*** and ***SS:The*** number range 0~59;**< *YYYY.MM.DD* >**current year/month/day, ***YYYY:The*** number range 1970~2100, ***MM: The*** number range 1~12, ***DD: The*** number range 1~31.
Command mode: Admin Mode
Default: The default date is 2001—Jan-01 0:0:0.
Usage Guide: system clock of the switch will be reset when power is down. The system clock should be re-initialized through this command after power reset.
Example: Set the system clock to Aug. 1st, 2002, commands should be entered as below:
Switch#clock set 23:0:0 2002.8.1
Relative command: show clock

5.1.2 config

Command: config [terminal]
Function: Convert from admin mode to global mode.
Parameter: [terminal] to configure
Command mode: Admin Mode
Example:
Switch#config

5.1.3 exec timeout

Command: exec timeout <*minutes* >
Function: Configure the overtime of quitting privileged configuration mode.
Parameter: < *minute* >is time; the unit is minute(The range 0~300)
Command mode: Global Mode
Default: The default time is 5 minutes.
Usage Guide: For security reason, a timer can be set for the privileged user's login session through this command. And the timer will be enabled when there are no operations in the login session. When timeout happens, the privileged session will be terminated automatically. User name and password should be entered again in order to re-enable the privilege login session. If the timer is set to 0, it will be disabled.
Example: Set the time out limits to 6 minutes:
Switch(Config)#exec timeout 6

5.1.4 exit

Command: exit
Function: Quit from the current mode quit and return the previous mode. By this command, users being in global mode will return to admin configuration mode; users being admin mode will return to user mode.
Command mode: All Modes
Example:
Switch#exit
Switch>

5.1.5 help

Command: help
Function: Output brief description of the command interpreter help system.
Command mode: All Modes
Usage Guide: An instant online help provided by the switch. Help command displays information about the whole help system, including complete help and partial help. The user can type in any time to get online help.
Example:
Switch>help

enable	-- Enable Privileged mode
exit	-- Exit telnet session
help	-- help
show	-- Show running system information

5.1.6 ip host

Command: ip host <hostname> <ip_addr>
no ip host <*hostname*>
Function: Set the mapping relationship between the host and IP address; the 'no ip host' parameter of this command will delete the mapping.
Parameter: <*hostname*> is the host name, up to 15 characters are allowed; **<*ip_addr*>** is the corresponding IP address for the host name, takes a dot decimal format.
Command mode: Global **Mode**
Usage Guide: Maps between hostname and ip address can be set through this command, for operations such as 'ping <host>'.
Example: Set 200.121.1.1 as the ip address of a host named beijing:
Switch(Config)#ip host beijing 200.121.1.1
Relative command: telnet、ping、traceroute

5.1.7 ip http server

Command: ip http server
no ip http server
Function: Enable the Web configuration; the 'no no ip http server' command is used to disable the Web configuration.
Command mode: Global Mode.
Usage Guide: Web interface can be a choice to configure the switch through this command. Its simple, easy to use and easy to understand. This command has the same effect as choosing option 2 in the Setup configuration mode.
Example: Enable the web configuration interface:
Switch(Config)#ip http server
Relative Command: web-user.

5.1.8 hostname

Command: hostname <*hostname*>
Function: Set the prompt in the switch command line interface.
Parameter:<*hostname*> is the string for the prompt, up to 30 characters are allowed.
Command mode: Global Mode
Default: The default prompt is related to DCS-3950 series switch type.
Usage Guide: Shell prompt can be changed and customized through this command.
Example: Customize the promption as Test:
Switch(Config)#hostname Test
Test(config)#

5.1.9 reload

Command: reload
Function: Warm reset the switch.
Command mode: Admin Mode
Usage Guide: The switch can be rebooted through this command without resetting the power.

5.1.10 set default

Command: set default
Function: Reset the switch to factory settings.
Command mode: Admin Mode
Usage Guide: The switch will be reset to the factory state through this command. All the configurations will be reset after system reboot.
Notice: the **write** command should be issued after the above command, in order to save the results. Switch configurations will be reset to factory mode after system reboot.
Example:
Switch#set default
Are you sure? [Y/N] = y
Switch#write
Switch#reload

5.1.11 setup

Command: setup
Function: Enter the Setup Mode of the switch.
Command mode: Admin Mode
Usage Guide: Configuration such as Ip addressed and web services can be done through this command in the Setup mode.

5.1.12 language

Command: language {chinese|english}
Function: Set the language for displaying the help information.
Parameter: Chinese for Chinese display; **English** for English display.
Command mode: Admin Mode
Default: The default setting is English display.
Usage Guide: Language for the system can be customized through this command according to the requirement. System language will be reset to English by default.

5.1.13 web-user

Command：web-user <*username*> password {0|7} <*password*>
no web-user <*username*>
Function：Set a username and its password for a Web client; the ‘no web-user <username>‘ command is used to delete this Web client.
Parameters：***<username>***is an authorized username to do Web access, whose length should be no more than 16 characters; ***<password>*** is the access password, no longer than 8 characters; **0|7** respectively indicate to display the original or the encrypted password.
Command mode：Global Mode.
Usage Guide: To prevent un-authorized users from accessing the web interface, user names and passwords can be created for accessing the web interface through this command.
Example: Create a user name *Admin* with *switch* as its password.
Switch(Config)#web-user Admin password 0 switch
Relative Command: ip http server

5.1.14 write

Command: write
Function: Save the currently configured parameters to the Flash memory.
Command mode: Admin Mode
Usage Guide: With this command, valid configurations can be preserved in the flash. And system can recover its preserved configuration after system reset. This command has the same effect as **copy running-config startup-config**

5.1.15 show cpu usage

Command：show cpu usage
Function：Display the CPU usage rate of the switch
Command mode: Admin Mode.
Usage Guide: load of the system can be presented through this command.
Example:
Switch#show cpu usage
Last 5 second CPU IDLE: 99%
Last 30 second CPU IDLE: 99%
Last 5 minute CPU IDLE: 99%
From running CPU IDLE: 99%

5.1.16 show tech-support

Command：show tech-support
Function： Collect tech-support information.
Command mode: Admin Mode.
Usage Guide: Information can be get through this command for determining the cause of any system failure.
Example:
Switch#show tech-support

5.1.17 vendorcontact

Command：vendorcontact <*information*>
Function：Set vendor contact information in the switch.
Parameters：< *information* > is vendor contact information letters.
Command mode：Global Mode.
Usage Guide：The vendor contact information in this command can be telephone, fax, etc.
Example：Set vendor contact 800-810-9119
Switch(Config)# vendorcontact 800-810-9119

5.1.18 vendorlocation

Command：vendorlocation <*information*>
Function：Set switch location information
Parameters：*<information>* is switch location information letters.
Command mode：Global Mode.
Usage Guide：Set switch location to China.
Switch(Config)#vendorlocation china

5.1.19 web-language

Command：web-language {chinese| english}
Function：Set web language.
Parameters：*chinese:* set web language to Chinese.
english: set web language to English.
Command mode：Global Mode.
Usage Guide：reset switch to make effective of web language.
Example：set web language to English:
Switch(Config)#web-language english

5.2 Monitor and Debug Command List

When the users configures the switch, they will need to verify whether the configurations are correct and the switch is operating as expected, and in network failure, the users will also need to diagnostic the problem. DCS-3950 series switch provides various debug commands including ping, telnet, show and debug, etc. to help the users to check system configuration, operating status and locate problem causes.

5.2.1 Ping

Command：ping [<*ip-addr*>|<hostname>]
Function: the switch sends ICMP request packet to remote client device and checks the communications between both sides is fine or not.
Parameter: <*ip-addr*>is destination host IP address, in dotted decimal notation.
<hostname> is destination host name, number and letter constitute character string.Blank is not allowed,the length of character string is from 1 to 30.
Default: send 5 ICMP request packets; the packet size is 56 bytes; timeout is 2 seconds.
Command mode: Admin Mode
Usage Guide: Interactive configuration mode is provided if the **ping** command is entered without any parameters. Ping parameters can be set this way.
Example
Ex.1: To use the default options of ping.
Switch#ping 10.1.128.160
Type ^c to abort.
Sending 5 56-byte ICMP Echos to 10.1.128.160, timeout is 2 seconds.
...!!
Success rate is 40 percent (2/5), round-trip min/avg/max = 0/0/0 ms

For the above example, ping will be send from the switch to some device with 10.1.128.160 as its ip address. For the first three ICMP echo packets, the switch considers the other side to be unreachable because the corresponding ICMP reply packets can not be retrieved with 2 seconds after the echo packets are sent out. For the following two echo packets, reply is retrieved correctly, so the success rate is 40%. Here, failure is denoted as '.', while success is denoted as '!'.
Ex.2: Launch the ping command with customized parameters.
Switch#ping
Target IP address：10.1.128.160
Repeat count [5]：100
Datagram size in byte [56]：1000
Timeout in milli-seconds [2000]：500
Extended commands [n]：n

Parameters	Notes
protocol [IP]：	Protocol for the ping command.

Target IP address：	Ip address of the target device.
Repeat count [5]	Number of ping echo packets to be sent. Default is 5.
Datagram size in byte [56]	Size of the ping echo packet in bytes. Default is 56.
Timeout in milli-seconds [2000]：	Timeout for the reply packets in milliseconds. Default is 2 seconds.
Extended commands [n]：	Whether need to change other option.

5.2.2 Telnet

5.2.2.1 Introduction to Telnet

Telnet is a simple remote terminal protocol for remote login. Using Telnet, the user can login to a remote host with its IP address of hostname from his own workstation. Telnet can send the user's keystrokes to the remote host and send the remote host output to the user's screen through TCP connection. This is a transparent service, as to the user, the keyboard and monitor seems to be connected to the remote host directly.

Telnet employs the Client-Server mode, the local system is the Telnet client and the remote host is the Telnet server. DCS-3950 series switch can be either the Telnet Server or the Telnet client.

When DCS-3950 series switch is used as the Telnet server, the user can use the Telnet client program included in Windows or the other operation systems to login to DCS-3950 series switch, as described earlier in the In-band management section. As a Telnet server, DCS-3950 series switch allows up to 5 telnet client TCP connections.

And as Telnet client, using **telnet** command under Admin Mode allows the user to login to the other remote hosts. DCS-3950 series switch can only establish TCP connection to one remote host. If a connection to another remote host is desired, the current TCP connection must be dropped.

5.2.2.2 Telnet Configuration Task List

1. Configuring Telnet Server

2. Telnet to a remote host from the switch

1. Configuration of Telnet Server

Command	Explanation
Global Mode	
telnet-server enable	Enable the Telnet server function in the

no telnet-server enable	switch: the **'no telnet-server enable'** command disables the Telnet function.
telnet-user <*user-name*> password {0|7} <*password*> **no telnet-user <*user-name*>**	Configure the username and password to login to the switch through Telnet: the **no telnet-user <*user-name*>** command disables Telnet accredited user.
telnet-server securityip <*ip-addr*> **no telnet-server securityip <*ip-addr*>**	Configure the secure IP address to login to the switch through Telnet: the '**no telnet-server securityip <*ip-addr*>' command deletes the authorized Telnet secure address.**
authentication login {local|radius|local radius|radius local} **no authentication login**	Configure validatory mode of long-distance login in
Admin Mode	
Monitor **no monitor**	Display debug information for Telnet client login to the switch; the '**no monitor'** command disables the debug information.

2. Telnet to a remote host from the switch

Command	Explanation
Admin Mode	
telnet [<*ip-addr*>] [<*port*>]	Login to a remote host with the Telnet client included in the switch.

5.2.2.3 Telnet Command List

5.2.2.3.1 authentication login

Command：authentication login {local | radius | local radius | radius local}
no authentication login

Function：Configure the Telnet Server to set the password authentication mode and privilege of remote access users; the 'no authentication login' command is used to reset it to the default authentication mode.

Default Setting：The default access authentication mode is local.

Command mode：Global Mode.

Usage Guide: When combined authentication is used, authentication method in the front will be of the highest priorities. And the latter, the lower. If a user is approved by any authentication method of higher priority, any authentication method of lower priority will be ignored. To be noticed, when radius is used for authentication, AAA must be enabled, and a dedicated radius server should be configured.

Example: Configure the authentication method for remote access to be radius.
Switch(Config)#authentication login radius
Relative Command：aaa enable，radius-server authentication host

5.2.2.3.2 monitor

Command: monitor
no monitor
Function: Make Telnet clients display debug information, and disable Console clients to display debug information function. Use the 'no' command to disable Telnet client display debug information function and restore Console client display debug information function.
Command mode: Admin Mode
Usage Guide: By default, any debug information will be output to the Console port of the swich, but not the remote telnet session. With this command, debug information can be redirected to the specified remote telnet session, but not the Console port or any other telnet sessions.
Example: Enable debug information output through telnet sessions.
Switch#monitor
Relative Command：telnet-user

5.2.2.3.3 telnet

Command:telnet [<*ip-addr*>|<*ip-host-name*>] [<*port*>]
Parameter： ***<ip-addr>*** is the IP address of the remote host, shown in dotted decimal notation;***<hostname>*** is the name of the remote host,containing max 30 characters;***<port>*** is the port number,ranging between 0~65535.
Command mode: Admin Mode
Usage Guide: This command is used to set up telnet configuration sessions through one switch as the telnet client to another. When the switch is used as telnet client, only one remote session can be setup at the same time. In order to connect to another host, any existing TCP connections should be disconnected before the new connection is setup. To disconnect any existing sessions, Please use 'Ctrl + I'.
If no parameters are appended to the telnet command, interactive configuration mode will be invoked.
Ex1: To telnet to a remote router named ROUTER with ip address as 20.1.1.1.
Switch#telnet 20.1.1.1 23
Trying 20.1.1.1...
Service port is 23
Connected to 20.1.1.1
login:123
password:***
DCR>
Ex2: Set the host name of a remote router ROUTER with ip address as 20.1.1.1 as aa.

Then telnet the remote host through the host name.
Switch#config
Switch（Config）#ip host aa 20.1.1.1
Switch（Config）#exit
Switch#telnet aa 23
Trying 20.1.1.1...
Service port is 23
Connected to 20.1.1.1
login:123
password:***
router>
Relative Command：ip host

5.2.2.3.4 telnet-server enable

Command:：telnet-server enable
no telnet-server enable
Function: Enable the Telnet server function in the switch: the '**no telnet-server enable'** command disables the Telnet function in the switch.
Default: Telnet server function is enabled by default.
Command mode: Global Mode
Usage Guide: This command can only be invoked within the Console port. And remote telnet session to the switch can be enabled or disabled through this command.
Example: Disable the telnet server for the switch.
Switch(Config)#no telnet-server enable

5.2.2.3.5 telnet-server securityip

Command: telnet-server securityip <*ip-addr*>
no telnet-server securityip <*ip-addr*>
Function: Configure the secure IP address of Telnet client allowed to login to the switch; the '**no telnet-server securityip <*ip-addr*>'** command deletes the authorized Telnet secure address.
Parameter: <*ip-addr*> is the secure IP address allowed to access the switch, in dot decimal format.
Default: no secure IP address is set by default.
Command mode: Global Mode
Usage Guide: IP address of telnet client to the switch is not restricted before secure IP address is configured. Only the host in the secure IP address list can telnet to the remote switch. Multiple security ip address can be configure at the same time.
Example: Set 192.168.1.21 as the secure ip address.
Switch(Config)#telnet-server securityip 192.168.1.21

5.2.2.3.6 telnet-user

Command：telnet-user *<username>* password {0|7} *<password>*
no telnet-user *<username>*
Function: Configure user names and passwords of Telnet clients. Use the '**no telnet-user *<username>***' command to remove the Telnet users.
Parameter: *<username>is the* Telnet client user name. The maximum length may not exceed 16 characters; ***<password>is the*** login password, the maximum length may not exceed 8 characters; **0|7** part means as passwords displayed not encrypted or encrypted
Command mode: Global Mode
Default: The default system does not configure Telnet client user name and password.
Usage Guide: This command is used when the switch is configured as a telnet server. Authenticated telnet users can be configured through this command. If no authenticated users are configured, any telnet client can never configure the switch through telnet. When the switch is configured as a telnet server, maximum of 5 telnet connections can be maintained by the switch.
Example: Setup a telnet user who named **Antony**, and the password is **switch**.
Switch(Config)#telnet-user Antony password 0 switch

5.2.3 SSH

5.2.3.1 Introduction to SSH

SSH (Secure Shell) is a protocol which ensures a secure remote access connection to network devices. It is based on the reliable TCP/IP protocol. By conducting the mechanism such as key distribution, authentication and encryption between SSH server and SSH client, a secure connection is established. The information transferred on this connection is protected from being intercepted and decrypted. The switch meets the requirements of SSH2.0. It supports SSH2.0 client software such as SSH Secure Client and putty. Users can run the above software to manage the switch remotely.

The switch presently supports RSA authentication, 3DES cryptography protocol and SSH user password authentication etc.

5.2.3.2 SSH Server Configuration Task List

1. SSH Server Configuration

Command	Explanation
Global Mode	

ssh-server enable **no ssh-server enable**	Enable SSH function on the switch; the '**no ssh-server enable**' command disables SSH function.
ssh-user <*user-name*> password {0|7} <*password*> **no ssh-user <*user-name*>**	Configure the username and password of SSH client software for logging on the switch; the '**no ssh-user <user-name>**' command deletes the username.
ssh-server timeout <*timeout*> **no ssh-server timeout**	Configure timeout value for SSH authentication; the '**no ssh-server timeout**' command restores the default timeout value for SSH authentication.
ssh-server authentication-retires <*authentication-retires*> **no ssh-server authentication-retries**	Configure the number of times for retrying SSH authentication; the '**no ssh-server authentication-retries**' command restores the default number of times for retrying SSH authentication.
ssh-server host-key create rsa modulus <*moduls*>	Generate the new RSA host key on the SSH server.
Admin Mode	
monitor **no monitor**	Display SSH debug information on the SSH client side; the '**no monitor**' command stops displaying SSH debug information on the SSH client side.

5.2.3.3 SSH Command List

5.2.3.3.1 ssh-server enable

Command: ssh-server enable
no ssh-server enable
Function: Enable SSH function on the switch; the '**no ssh-server enable**' command disables SSH function.
Command mode: Global Mode
Default: SSH function is disabled by default.
Usage Guide: SSH users should be configured and SSH service should be enabled before SSH clients can connect to the switch.
Example: Enable the SSH service of the switch.
Switch(Config)#ssh-server enable

5.2.3.3.2 ssh-user

Command: ssh-user <*username*> password {0|7} <*password*>

no ssh-user <*username*>

Function: Configure the username and password of SSH client software for logging on the switch; the '**no ssh-user <user-name>**' command deletes the username.

Parameter: <*username*> is SSH client username. It can't exceed 16 characters; **<*password*>** is SSH client password. It can't exceed 8 characters; **0|7** stand for unencrypted password and encrypted password.

Command mode: Global Mode

Default: There are no SSH username and password by default.

Usage Guide: Authenticated SSH clients are configured through this command. Any SSH clients will not be able to connect to the switch with out the authentication. When the switch configured as SSH server, maximum of 3 users can be configured. And maximum of 3 concurrent SSH sessions can be setup.

Example: Setup a SSH client named **switch**, with its password as **switch**.

Switch(Config)#ssh-user switch password 0 switch

5.2.3.3.3 ssh-server timeout

Command: ssh-server timeout <*timeout*>

no ssh-server timeout

Function: Configure timeout value for SSH authentication; the '**no ssh-server timeout**' command restores the default timeout value for SSH authentication.

Parameter: <*timeout*> is timeout value; valid range is 10 to 600 seconds.

Command mode: Global Mode

Default: SSH authentication timeout is 180 seconds by default.

Usage Guide: Timeout for authenticated SSH client can be set through this command. Default is 180 seconds.

Example: Set the timeout for SSH authentication to be 240 seconds.

Switch(Config)#ssh-server timeout 240

5.2.3.3.4 ssh-server authentication-retries

Command: ssh-server authentication-retries < authentication-retries >

no ssh-server authentication-retries

Function: Configure the number of times for retrying SSH authentication; the '**no ssh-server authentication-retries**' command restores the default number of times for retrying SSH authentication.

Parameter: < authentication-retries > is the number of times for retrying authentication; valid range is 1 to 10.

Command mode: Global Mode

Default: The number of times for retrying SSH authentication is 3 by default.

Usage Guide:

Example: Setup retry limits for authentications for SSH clients.

Switch(Config)#ssh-server authentication-retries 5

5.2.3.3.5 ssh-server host-key create rsa

Command：ssh-server host-key create rsa [modulus < modulus >]
Function: Generate new RSA host key
Parameter: modulus is the modulus which is used to compute the host key; valid range is 768 to 2048. The default value is 1024.
Command mode: Global Mode
Default: The system uses the key generated when the ssh-server is started at the first time.
Usage Guide: This command is used to create new security keys for the host. After the key is created, SSH clients will have to use the key in order to communicate with the host. If the configuration for the new key is preserved through the write command, the system will use the key for host authentications. For encrypting and decrypting of the key is quite time consuming, as well as some client does not support keys which are of modulus of 2048 bits, it is recommended to use the default modulus of 1024 bits for computation of the keys for the efficiency and compatibilityreasons.
Example: Create a new key for the host.
Switch(Config)#ssh-server host-key create rsa

5.2.3.3.6 monitor

Command：monitor
no monitor
Function: Display SSH debug information on the SSH client side; at the same time disable function of debug information in console,the '**no monitor**' command stops displaying SSH debug information on the SSH client side,enable function of debug information in console
Command mode: Admin Mode
Usage Guide: By default, the debug information will be output to the Console port of the switch but not the SSH login session if the debug information is enabled on the switch. With this command, debug information can be redirected to the specified SSH login session, but not the Console port or any other telnet or SSH login session.
Example: Enable debug information for the SSH client.
Switch#monitor
Relative Command: ssh-user

5.2.3.4 SSH Server Configuration Example

Scenario 1：

Requirement: Enable SSH server on the switch, and run SSH2.0 client software such as secure shell client and putty on the terminal. Log on the switch by using the username and password from the client.

Configure the IP address, add SSH user and enable SSH service on the switch. SSH2.0 client can log on the switch by using the username and password to configure the

switch.
Switch(Config)#interface vlan 1
Switch(Config-Vlan-1)#ip address 100.100.100.200 255.255.255.0
Switch(Config-Vlan-1)#exit
Switch(Config)#ssh-user test password 0 test
Switch(Config)#ssh-server enable

5.2.3.5 SSH Monitor and Debug Command List

5.2.3.5.1 show ssh-user

Command：show ssh-user
Function：Display all the configured SSH usernames.
Command mode：Admin Mode.
Example:
Switch#show ssh-user
test
Relative Command：ssh-user

5.2.3.5.2 show ssh-server

Command：show ssh-server
Function：Display the state of SSH server (open or closed) and the information of users who has already logged in.
Command mode：Admin Mode.
Example:
Switch#show ssh-server
ssh-server is enabled

connection	version	state	user name
1	2.0	session started	test

Relative Command：ssh-server enable，no ssh-server enable

5.2.3.5.3 debug ssh-server

Command：debug ssh-server
no debug ssh-server
Function：Enable the debug information of SSH server. The ‘no debug ssh-server ‘ command is used to disable the debug information of SSH server.
Default：By default, the debug information is disabled.
Command mode：Admin Mode.

5.2.4 Traceroute

Command：traceroute {*<ip-addr>* | host *<hostname>* }[hops *<hops>*] [timeout *<timeout>*]

Function：This command is used to test the gateways passed by packets on their way from sending equipment to destination equipment, in order to check whether the network can be reached and to locate the fault of network.

Parameters：*<ip-addr>*is the IP address of the destination host, in dotted-decimal format; ***<hostname>***is the host name of the remote host. ***<hops>*** is the max number of passed gateways allowed by Traceroute. ***<timeout>***is the timeout value of packets, in millisecond, ranging from 100 to 10000.

Default：The max number of passed gateways is set by default as 16, while the timeout value is 2000 milliseconds.

Command mode：Admin Mode.

Usage Guide: Traceroute is used to locate the failure of the network when the destination is not reachable.

Relative Command：ip host

5.2.5 Show

show command is used to display information about the system , port and protocol operation. This part introduces the **show** command that displays system information, other **show** commands will be discussed in other chapters.

5.2.5.1 show arp

Command：show arp

Function: Display ARP Mapping table

Command mode: Admin Mode

Usage Guide: Contents of current ARP mapping can be showed with this command, including IP addresses, hardware addresses, hardware types, and interface names, etc.

Example:

Switch#show arp

Total arp items is 2, the matched arp items is 2

Address	Hardware Addr	Interface	Port	Flag
1.1.1.2	00-03-0F-43-65-73	Vlan1	Ethernet0/0/23	Dynamic
192.168.1.145	00-03-0F-FE-38-8A	Vlan1	Ethernet0/0/23	Dynamic

5.2.5.2 show clock

Command：show clock

Function: Display current system clock

Command mode: Admin Mode

Usage Guide: System clock can be showed through this command. For any inaccuracy, users can make changes.

Example:
Switch#show clock
Current time is TUE AUG 22 11：00：01 2002
Relative Command: clock set

5.2.5.3 show debugging

Command：show debugging
Function： Display the debugging state
Usage Guide: This command is used to show which debug options are enabled.
Command mode: Admin Mode
Example: Show the debug options currently configured.
Switch#show debugging
STP:
Stp input packet debugging is on
Stp output packet debugging is on
Stp basic debugging is on
Relative Command ：debug

5.2.5.4 show flash

Command：show flash
Function： Display the document in the flash
Command mode: Admin Mode
Example: Check the size of files in the flash.
Switch#show flash
file name file length
nos.img 1122380 bytes
startup-config 1061 bytes
running-config 1061 bytes
Switch#

5.2.5.5 show history

Command：show history
Function：Display the recent user input history command
Command mode: Admin Mode
Usage Guide: The system will preserve up to 10 history command that are entered by users. History command can be recovered by the UP key and DOWN key, or the equivalent Ctrl+P and Ctrl+N.
Example:
Switch#show history
enable
config

interface ethernet 0/0/3
enable
show flash
show ftp

5.2.5.6 show memory

Command：show memory
Function：Display the contents in the memory
Command mode: Admin Mode
Usage Guide: This command is used for debugging purpose. Base memory address and length can be entered through interactive way. The information given by the system falls in to three parts, which are the addresses, memory dump in lexical words, and the corresponding ASCII characters.
Example:
Switch#show memory
start address : 0x2100
number of words[64]:

002100: 0000 0000 0000 0000 0000 0000 0000 0000 *.....*
002110: 0000 0000 0000 0000 0000 0000 0000 0000 *.....*
002120: 0000 0000 0000 0000 0000 0000 0000 0000 *.....*
002130: 0000 0000 0000 0000 0000 0000 0000 0000 *.....*
002140: 0000 0000 0000 0000 0000 0000 0000 0000 *.....*
002150: 0000 0000 0000 0000 0000 0000 0000 0000 *.....*
002160: 0000 0000 0000 0000 0000 0000 0000 0000 *.....*
002170: 0000 0000 0000 0000 0000 0000 0000 0000 *.....*

5.2.5.7 show rom

Command：show rom
Function：Display enabled document and bulk
Command mode: Admin Mode
Example: To show the information about bootup file.
Switch#sh rom
file name file length
nos.rom 170992 bytes

5.2.5.8 show running-config

Command: show running-config
Function: Display the current active configuration parameters for the switch.
Default: If the active configuration parameters are the same as the default operating parameters, nothing will be displayed.

Command mode: Admin Mode
Usage Guide: The 'show running-config' is used to verify whether the users had entered the configurations correctly.
Example:
Switch#show running-config

5.2.5.9 show startup-config

Command: show startup-config
Function: Display the switch parameter configurations written into the Flash memory at the current operation; those are usually also the configuration files used for the next power-up.
Default: If the configuration parameters read from the Flash are the same as the default operating parameter, nothing will be displayed.
Command mode: Admin Mode
Usage Guide: There are some differences between the commands **show running-config** and **show startup-config**. Newly configured options can be shown through the **show running-config** command, but can not be show through **show startup-config**.The result will be the same for the both commands only if the **write** command has been issued, and the current configurations have been preserved in the system flash.

5.2.5.10 show switchport interface

Command: show switchport interface [ethernet <interface-list>]
Function: Show the VLAN port mode, VLAN number and Trunk port messages of the VLAN port mode on the switch.
Parameter: <*interface-list*> is the port number or port list, which could be maximum of 0/0/1 port in the switch
Mode: Privileged configuration mode.
Example: To show vlan configurations of interface 0/0/1.
Switch#show switchport interface ethernet 0/0/1
Ethernet0/0/1
Type:Universal
Mac addr num:-1
Mode :Access
Port VID :1
Trunk native Vlan :1
Trunk allowed Vlan : ALL

Parameters	Descriptions
Ethernet0/01	The port name of the Ethernet interface.
Type	The state of the current interface.
Mac addr num	The maximum size of the table of MAC addresses that the

	current interface is able to maintain.
Mode :Access	Vlan mode for the current interface.
Port VID :1	The vlan id which the current interface belongs to.
Trunk native Vlan :1	The PVID of native VLAN for the trunk.
Trunk allowed Vlan :ALL	VLANs that are allowed to be transferred through trunk.

5.2.5.11 show tcp

Command: show tcp

Function: Display the current TCP connection status established to the switch.

Command mode: Admin Mode

Example:

Switch#show tcp

LocalAddress	LocalPort	ForeignAddress	ForeignPort	State
0.0.0.0	23	0.0.0.0	0	LISTEN
0.0.0.0	80	0.0.0.0	0	LISTEN

Parameters	Descriptions
LocalAddress	The local addresses for TCP connections.
LocalPort	The local ports for TCP connections.
ForeignAddress	The foreign addresses for TCP connections.
ForeignPort	The foreign ports for TCP connections.
State	The current state for the TCP connections.

5.2.5.12 show udp

Command: show udp

Function: Display the current UDP connection status established to the switch.

Command mode: Admin Mode

Example:

Switch#show udp

LocalAddress	LocalPort	ForeignAddress	ForeignPort	State
0.0.0.0	161	0.0.0.0	0	CLOSED
0.0.0.0	123	0.0.0.0	0	CLOSED
0.0.0.0	1985	0.0.0.0	0	CLOSED

Parameters	Descriptions
LocalAddress	The local addresses for UDP connections.
LocalPort	The local ports for UDP connections.
ForeignAddress	The foreign addressed for UDP connections.
ForeignPort	The foreign ports for UDP conections.
State	The current states for the UDP connections.

5.2.5.13 show telnet login

Command: show telnet login
Function: Display Telnet user information that links with the switch
Command mode: Admin Mode.
Usage Guide: This command is used to retrieve information about remote telnet login sessions.
Example:
Switch#show telnet login
Authenticate login by local.
Login user:
Antony
Switch#

5.2.5.14 show telnet user

Command: show telnet user
Function: Display all Telnet user information that can login the switch via Telnet.
Command mode: Privileged configuration mode
Usage Guide: Display all Telnet user information that can login the switch via Telnet.
Example:
Switch#show telnet user
Antony
Relative Command: telnet-user password

5.2.5.15 show version

Command: show version
Function: Display the switch version.
Command mode: Admin Mode
Usage Guide: Hardware and software features can be displayed through this command.
Example:
Switch#show version
DCS-3950-28CT Device, Jun 19 2006 10:14:42
HardWare version is 1.00
SoftWare version is DCS-3950-28CT_1.0.4.0
DCNOS version is DCNOS_5.1.35.47
BootRom version is DCS-3950-28CT_1.2.3
Copyright (C) 2001-2006 by Digital China Networks Limited.
All rights reserved.
System up time: 0 days, 0 hours, 0 minutes, 27 seconds.

5.2.6 Debug

All the protocols DCS-3950 series switch supports have their corresponding debug commands. The users can use the information from debug commands for troubleshooting. Debug commands for their corresponding protocols will be introduced in the later chapters.

5.3 Configure the IP Address of the Switch

In theory, DCS-3950 series switch is a layer 2（Data Link Layer）device, which should not have an IP address, because IP address is a concept belonged to layer 3（Network Layer）.But, as a device used in network, switch needs a network address to be its unique identifier, so that the network manager can identify and control it.

The IP address of DCS-3950 series switch is set on the VLAN interface. The VLAN with an IP address is called management VLAN. All the in-band management of the switch is done through management VLAN.DCS-3950 series switch only allows one VLAN interface, so, to change the ID of the management VLAN, the original VLAN interface should be deleted first, and then create a new VLAN interface.

DCS-3950 series switch provides three IP address configuration methods:

- ☞ Manual
- ☞ BootP
- ☞ DHCP

Manual configuration of IP address is assign an IP address manually for the switch.

In BootP/DHCP mode, the switch operates as a BootP/DHCP client, send broadcast packets of BootPRequest to the BootP/DHCP servers, and the BootP/DHCP servers assign the address on receiving the request. In addition, DCS-3950 series switch can act as a DHCP server, and dynamically assign network parameters such as IP addresses, gateway addresses and DNS server addresses to DHCP clients DHCP Server configuration is detailed in later chapters.

5.3.1 Switch IP Addresses Configuration Task List

1. Manual configuration
2. BootP configuration
3. DHCP configuration

1. Manual configuration

Command	Explanation
ip address <*ip_address*> <*mask*> **no ip address <*ip_address*> <*mask*>**	Configure IP address of the switch; the '**no ip address <*ip_address*> <*mask*>**' command deletes IP address of the switch.

2. BootP configuration

Command	Explanation
ip bootp-client enable **no ip bootp-client enable**	Enable the switch to be a BootP client and obtain IP address and gateway address through BootP negotiation; the **no ip bootp-client enable**' command disables the BootP client function.

3. DHCP

Command	Explanation
ip dhcp-client enable **no ip dhcp-client enable**	Enable the switch to be a DHCP client and obtain IP address and gateway address through DHCP negotiation; the '**no ip dhcp-client enable**' command disables the DHCP client function.

5.3.2 Switch IP Address Configuration Command List

5.3.2.1 ip address

Command：ip address <*ip-address*> <*mask*> [secondary]
no ip address [<*ip-address*> <*mask*>] [secondary]

Function：Configure the IP address and corresponding address mask for the switch. If **no** is put in front of the command, the related configuration will be removed.

Parameter：*<ip address>*is the ip address in dotted decimal format; **<mask>** is the net mask for the ip address in dotted decimal format ***[secondary]*** denotes the secondary ip address.

Default: no ip address is configured by default.

Command mode: VLAN interface configuration mode.

Usage Guide: At lease one Vlan should be configured before the ip address can be configured.

Example: Configure ip address for VLAN1 interface as 10.1.128.1/24.

```
Switch(Config)#interface vlan 1
Switch(Config-If-Vlan1)#ip address 10.1.128.1 255.255.255.0
Switch(Config-If-Vlan1)#no shut
Switch(Config-If-Vlan1)#exit
Switch(Config)#
```

Relative Commands：ip bootp-client enable、ip dhcp-client enable

5.3.2.2 ip bootp-client enable

Command：ip bootp-client enable

no ip bootp-client enable

Function: Configure the switch as a BootP client. The switch is able to get ip addressed for itself and the gateway through the BootP protocol. If **no** is put in front of the command, the BootP protocol will be disabled on the switch.

Default: BootP client is disabled by default.

Command mode: VLAN interface configuration mode.

Usage Guide: There three method to configure the IP address for the switch, including BootP, manually configuration, and DHCP. These three methods are mutually exclusive. Only one method can be used at the same time. Note: To obtain IP address via BOOTP, a DHCP server or a BOOTP server is required in
the network.

Example: BootP protocol to get the IP address.

Switch(Config)#interface vlan 1
Switch(Config-If-Vlan1)#ip bootp-client enable
Switch(Config-If-Vlan1)#no shutdown
Switch(Config-If-Vlan1)#exit
Switch(Config)#

Relative Commands：ip address、ip dhcp-client enable

5.3.2.3 ip dhcp-client enable

Command：ip dhcp-client enable
no ip dhcp-client enable

Function: Configure the switch as a DHCP client, and retrieve IP addresses for itself and the gateway through the DHCP protocol. If ***no*** is put in front of the command, the DHCP client configuration will be disabled.

Default: The DHCP client configuration is disabled by default.

Comand mode: VLAN interface configuration mode.

Usage Guide: Manual IP configuration, BooP and DHCP configurations are mutually exclusive. Only one can be active at the same time. To retrieve IP addressed through DHCP, there must be an available DHCP server in the network.

Example: Configure IP address through DHCP.

Switch(Config)#interface vlan 1
Switch(Config-If-Vlan1)#ip dhcp-client enable
Switch(Config-If-Vlan1)#no shut
Switch(Config-If-Vlan1)#exit
Switch(Config)#

Relative Commands：ip address、ip bootp-client enable

5.4 SNMP Configuration

5.4.1 Introduction to SNMP

SNMP (Simple Network Management Protocol) is a standard network management protocol widely used in computer network management. SNMP is an evolving protocol. SNMP v1 [RFC1157] is the first version of SNMP which is adapted by vast numbers of manufacturers for its simplicity and easy implementation; SNMP v2c is an enhanced version of SNMP v1, which supports layered network management; SNMP v3 strengthens the security by adding USM (User-based Security Mode) and VACM (View-based Access Control Model).

SNMP protocol provides a simple way of exchange network management information between two points in the network. SNMP employs a polling mechanism of message query, and transmits messages through UDP (a connectionless transport layer protocol). Therefore it is well supported by the existing computer networks.

SNMP protocol employs a station-agent mode. There are two parts in this structure: NMS (Network Management Station) and Agent. NMS is the workstation on which SNMP client program is running. It is the core on the SNMP network management. Agent is the server software runs on the devices which need to be managed. NMS manages all the managed objects through Agents. The switch supports Agent function.

The communication between NMS and Agent functions in Client/Server mode by exchanging standard messages. NMS sends request and the Agent responds. There are seven types of SNMP message:

- Get-Request
- Get-Response
- Get-Next-Request
- Get-Bulk-Request
- Set-Request
- Trap
- Inform-Request

NMS sends queries to the Agent with Get-Request, Get-Next-Request, Get-Bulk-Request and Set-Request messages; and the Agent, upon receiving the requests, replies with Get-Response message. On some special situations, like network device ports are on Up/Down status or the network topology changes, Agents can send Trap messages to NMS to inform the abnormal events. Besides, NMS can also be set to alert to some abnormal events by enabling RMON function. When alert events are triggered, Agents will send Trap messages or log the event according to the settings. Inform-Request is mainly used for inter-NMS communication in the layered network management.

USM ensures the transfer security by well-designed encryption and authentication. USM encrypts the messages according to the user typed password. This mechanism ensures that the messages can’t be viewed on transmission. And USM authentication ensures that the messages can’t be changed on transmission. USM employs DES-CBC cryptography. And HMAC-MD5 and HMAC-SHA are used for authentication.

VACM is used to classify the users’ access permission. It puts the users with the same access permission in the same group. Users can’t conduct the operation which is not authorized.

5.4.2 Introduction to MIB

The network management information accessed by NMS is well defined and organized in a Management Information Base (MIB). MIB is pre-defined information which can be accessed by network management protocols. It is in layered and structured form. The pre-defined management information can be obtained from monitored network devices. ISO ASN.1 defines a tree structure for MID. Each MIB organizes all the available information with this tree structure. And each node on this tree contains an OID (Object Identifier) and a brief description about the node. OID is a set of integers divided by periods. It identifies the node and can be used to locate the node in a MID tree structure, shown in the figure below:

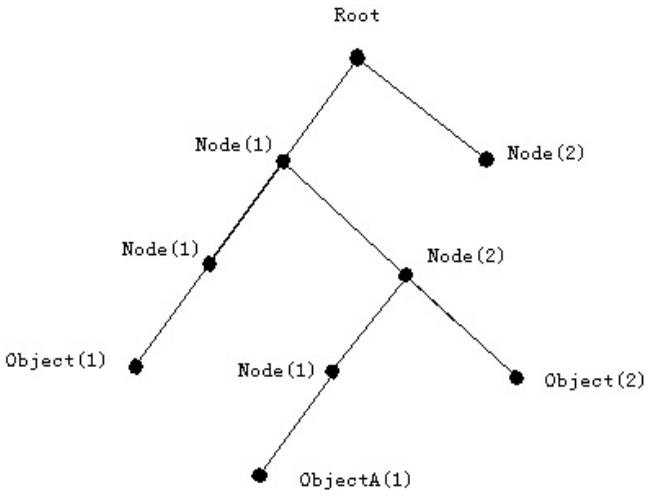


Fig 5-1 ASN.1 Tree Instance

In this figure, the OID of the object A is 1.2.1.1. NMS can locate this object through this unique OID and gets the standard variables of the object. MIB defines a set of standard variables for monitored network devices by following this structure.

If the variable information of Agent MIB needs to be browsed, the MIB browse software needs to be run on the NMS. MIB in the Agent usually consists of public MIB and private MIB. The public MIB contains public network management information that can be accessed by all NMS; private MIB contains specific information which can be viewed and controlled by the support of the manufacturers

MIB-I [RFC1156] is the first implemented public MIB of SNMP, and is replaced by MIB-II [RFC1213]. MIB-II expands MIB-I and keeps the OID of MIB tree in MIB-I. MIB-II contains sub-trees which are called groups. Objects in those groups cover all the functional domains in network management. NMS obtains the network management information by visiting the MIB of SNMP Agent.

The switch can operate as a SNMP Agent, and supports both SNMP v1/v2c and SNMP v3. The switch supports basic MIB-II, RMON public MIB and other public MID such

as BRIDGE MIB. Besides, the switch supports self-defined private MIB.

5.4.3 Introduction to RMON

RMON is the most important expansion of the standard SNMP. RMON is a set of MIB definitions, used to define standard network monitor functions and interfaces, enabling the communication between SNMP management terminals and remote monitors. RMON provides a highly efficient method to monitor actions inside the subnets.

MID of RMON consists of 10 groups. The switch supports the most frequently used group 1, 2, 3 and 9:

Statistics: Maintain basic usage and error statistics for each subnet monitored by the Agent.

History: Record periodical statistic samples available from Statistics.

Alarm: Allow management console users to set any count or integer for sample intervals and alert thresholds for RMON Agent records.

Event: A list of all events generated by RMON Agent.

Alarm depends on the implementation of Event. Statistics and History display some current or history subnet statistics. Alarm and Event provide a method to monitor any integer data change in the network, and provide some alerts upon abnormal events (sending Trap or record in logs).

5.4.4 SNMP Configuration

5.4.4.1 SNMP Configuration Task List

1. Enable or disable SNMP Agent server function
2. Configure SNMP community string
3. Configure IP address of SNMP management base
4. Configure engine ID
5. Configure user
6. Configure group
7. Configure view
8. Configuring TRAP
9. Enable/Disable RMON

1. **Enable or disable SNMP Agent server function**

Command	Explanation
snmp-server enable **no snmp-server enable**	Enable the SNMP Agent function on the switch; the ‘no snmp-server enable’ command disables the SNMP Agent function on the switch.

2. Configure SNMP community string

Command	Explanation
snmp-server community {ro|rw} <*string*> no snmp-server community <*string*>	Configure the community string for the switch; the 'no snmp-server community <*string*>'command deletes the configured community string.

3. Configure IP address of SNMP management base

Command	Explanation
snmp-server securityip <*ip-address*> no snmp-server securityip <*ip-address*>	Configure the secure IPv4/IPv6 address which is allowed to access the switch on the NMS; the 'no snmp-server securityip <*ip-address*> 'command deletes configured secure address.
snmp-server SecurityIP enable snmp-server SecurityIP disable	Enable or disable secure IP address check function on the NMS.

4. Configure engine ID

Command	Explanation
snmp-server engineid < *engine-string* > no snmp-server engineid < *engine-string* >	Configure the local engine ID on the switch. This command is used for SNMP v3.

5. Configure user

Command	Explanation
snmp-server user <*user-string*> <*group-string*> [[encrypted] {auth {md5|sha} <*password-string*>}] no snmp-server user <*user-string*> <*group-string*>	Add a user to a SNMP group. This command is used to configure USM for SNMP v3.

6. Configure group

Command	Explanation
snmp-server group <*group-string*> {NoauthNopriv|AuthNopriv|AuthPriv} [[read <*read-string*>] [write <*write-string*>] [notify <*notify-string*>]] no snmp-server group <*group-string*> {NoauthNopriv|AuthNopriv|AuthPriv}	Set the group information on the switch. This command is used to configure VACM for SNMP v3.

7. Configure view

Command	Explanation
snmp-server view <*view-string*>	Configure view on the switch. This

<*oid-string*> {include|exclude} no snmp-server view <*view-string*>	command is used for SNMP v3.

8. Configuring TRAP

Command	Explanation
snmp-server enable traps no snmp-server enable traps	Enable the switch to send Trap message. This command is used for SNMP v1/v2/v3.
snmp-server host <*host-address* > {v1|v2c|{v3 {NoauthNopriv|AuthNopriv|AuthPriv}}} <*user-string*> no snmp-server host <*host-address*> {v1|v2c|{v3 {NoauthNopriv|AuthNopriv |AuthPriv}}} <*user-string*>	Set the host IPv4/IPv6 address which is used to receive SNMP Trap information. For SNMP v1/v2, this command also configures Trap community string; for SNMP v3, this command also configures Trap user name and security level.

9. Enable/Disable RMON

Command	Explanation
rmon enable no rmon enable	Enable/disable RMON.

5.4.4.2 SNMP Configuration Command List

5.4.4.2.1 snmp-server enable

Command：snmp-server enable
no snmp-server enable
Function: Enable the switch as a SNMP proxy. If no is put in front of this command, SNMP proxy service will be disabled.
Command mode: Global Mode
Default: SNMP proxy service is disabled by default.
Usage Guide: SNMP proxy service should be enabled through this command before the switch can be configured through network management software.
Example: Enable SNMP proxy service.
Switch(Config)#snmp-server enable

5.4.4.2.2 snmp-server community

Command：snmp-server community {ro|rw} <*string*>
no snmp-server community <*string*>
Function: Configure the community string for the switch. If no is put in front of the command, this command will be disabled.
Command mode: Global Mode.
Parameters: Community string can be set through ***<string>.*** MIB database access

permission can be set through **ro|rw. ro** is for read only while **rw** for read/write.
Usage Guide: Up to 4 community strings are supported by the switch.
Example:
Setup a community string as private with read/write permission.
Switch(config)#snmp-server community rw private
Setup a community string as public with read only permission.
Switch(config)#snmp-server community ro public
Change the permission of private to read only.
Switch(config)#snmp-server community ro private
Remove the community string named private.
Switch(config)#no snmp-server community private

5.4.4.2.3 snmp-server enable traps

Command：snmp-server enable traps
no snmp-server enable traps
Function: Enable the switch to send the Trap messages. If no is put in front of this command, the configuration will be disabled.
Command mode: Global Mode.
Default: Trap messages are disabled by default.
Usage Guide: When Trap messages are enabled, Trap messages will be sent when the interfaces or the system become down/up.
Example:
Enable the trap messages.
Switch(config)#snmp-server enable traps
Disable the trap messages.
Switch(config)#no snmp-server enable trap

5.4.4.2.4 snmp-server engineid

Command: snmp-server engineid <*engine-string*>
no snmp-server engineid <*engine-string*>
Function: Configure the engine id for SNMP server. If no is put in front of this command, the engine id configuration will be disabled
Command mode: Global Mode.
Parameters: <engine string> is the engine id, which is presented in lexical characters with the length of 10.
Default: Corporation ID + local MAC address is configured by default.
Example: Configure the engine id as A66688000F.
Switch(config)#snmp-server engineid A66688999F
Recover the default engine id configuration.
Switch(config)#no snmp-server engineid A66688999F

5.4.4.2.5 snmp-server user

Command：snmp-server user <*user-string*> <*group-string*> [[encrypted] {auth {md5|sha} <*password-string*>}]
no snmp-server user <*user-string*> <*group-string*>

Function: Add a user to an existing group. the 'no' form of this command deletes this user

Command mode: Global Mode.

Parameters: <*user-string*> is the name of the user, which can be of 1 to 32 characters long. ***<group-string>*** is the group name for the user to be added to. If ***encrypted*** is configured, user passwords will be encrypted with DES encryption. If ***auth*** is configured, checksums of snmp packets will be verified. For ***md5*** option, HMAC MD5 algorithm will be used, while for ***sha***, HMAC SHA will be used. ***<password-string>*** is the password for the user, which is limited to 8 to 32 characters long.

Usage Guide: If encryption and authentication are not configured, the encryption and authentication are both disabled by default. If encryption is enabled, authentication must be enabled too. When deleting a user, if the input user name can be matched, the group name will be ignored. User can be deleted even if the input group name of the user does not match with the configurations.

Example: Add a user named tester to the group named Group. Encryption should be enabled and HMAC md5 should be used for authentication.

Switch (Config)#snmp-server user tester DCNGroup encrypted auth md5 hellohello

Delete a user：

Switch (Config)#no snmp-server user tester Group

5.4.4.2.6 snmp-server group

Command: snmp-server group <*group-string*> {NoauthNopriv|AuthNopriv|AuthPriv} [[read <*read-string*>] [write <*write-string*>] [notify <*notify-string*>]]
no snmp-server group <*group-string*> {NoauthNopriv|AuthNopriv|AuthPriv}

Function: Configure a new group for the switch. If no is put in front of this command, the specified group will be removed.

Command mode: Global Mode

Parameters: <group-name> is the name of the group, which should be between 1 and 32 characters long. Encryption and Authentication will be disabled if **NoauthNopriv** is set. Authentication will be enabled while encryption disabled if **AuthNopriv** is configured. And both authentication and encryption will be enabled if **AuthPriv** is set.

Usage Guide: A default view named v1defaultviewname is configured by the system. It is recommended that this view is used. If the read view or the write view is not configured, the corresponding operation will be disabled.

Example:

Create a view named Group, with authentication and encryption enabled, and a readable view named readview and the write operation disabled.

Switch (Config)#snmp-server group Group AuthPriv read readview

Delete a group.
Switch (Config)#no snmp-server group Group AuthPriv

5.4.4.2.7 snmp-server view

Command: snmp-server view <*view-string*> <*oid-string*> {include|exclude}
no snmp-server view <*view-string*>
Function: View configurations can be updated with this command. If no is put in front of this command, corresponding view configuration will be removed.
Command mode: Global Mode.
Parameter: <view-string> view name, containing 1-32 characters;
<oid-string>is OID number or corresponding node name, containing 1-255 characters.
include|exclude , include/exclude this OID
Usage Guide: The command supports not only the input using the character string of the variable OID as parameter. But also supports the input using the node name of the parameter
Example: Create a view, the name is readview, including iso node but not including the iso.3 node.
Switch (Config)#snmp-server view readview iso include
Switch (Config)#snmp-server view readview iso.3 exclude
Delete the view.
Switch (Config)#no snmp-server view readview

5.4.4.2.8 snmp-server host

Command:snmp-server host <*host-address*> {v1|v2c|{v3
{NoauthNopriv|AuthNopriv | AuthPriv}}} <*user-string*>
no snmp-server host <*host-address*> {v1|v2c|{v3
{NoauthNopriv|AuthNopriv |AuthPriv}}} <*user-string*>
Function: For v1 and v2c version, the IP address of the SNMP management station which receives the Trap messages and the Trap community string should be configured. For v3 version, the IP address of the SNMP server, and the user name and the security level should be configured. If no is put in front of this command, this command will be removed.
Command mode: Global Mode
Parameters: <host-addr> is the ip address of the NMS workstation which receives the Trap messages. **V1|v2c|v3** is the version number to be used by the Trap messages. **Noauth|Nopriv|AuthNopriv|AuthPriv** is the security level for trap messages of version v3. **<user-string>** is the community string for Trap messages of v1/v2c version. For the version of v3, it is the user name.
Usage Guide: The community string for Trap messages configured by this command is used as the default community string for RMON events. If no community strings are configured for the RMON events, community string configured by this command will be used. Otherwise, community string of RMON will be used for RMON Trap messages.

Example:
Configure the IP address of SNMP server to receive the Trap messages.
Switch(config)#snmp-server host 1.1.1.5 v1 trap
Remove the Trap meesage delivery configuration.
Switch(config)#no snmp-server host 1.1.1.5 v1 trap

5.4.4.2.9 snmp-server securityip

Command：snmp-server securityip *<ip-address>*
no snmp-server securityip *<ip-address>*
Function： Configure to permit to access security IP address of the switch NMS administration station; the'**no snmp-server securityip *<ip-address>***'command deletes configured security IP address.
Command mode： Global Mode
Parameter： **<ip-address>** is NMS security IP address, point separated decimal format.
Usage Guide： It is only the consistency between NMS administration station IP address and security IP address configured by the command, so it send SNMP package could be processed by switch, the command only applies to SNMPv1 and SNMPv2c.
Example：
Configure security IP address of NMS administration station.
Switch(config)#snmp-server securityip 1.1.1.5
Delete security IP address.
Switch(config)#no snmp-server securityip 1.1.1.5

5.4.4.2.10 snmp-server SecurityIP enable

Command：snmp-server SecurityIP enable
snmp-server SecurityIP disable
Function： Enable or disable secure IP address check function on the NMS.
Command mode： Global Mode
Default: Enable secure IP address check function
Example: Disable secure IP address check function.
Switch(config)#snmp-server securityip disable

5.4.4.2.11 rmon enable

Command：rmon enable
no rmon enable
Function: Enable RMON; the '**no rmon enable**' command disables RMON.
Command mode: Global Mode
Default: RMON is disabled by default.
Example : Enable RMON
Switch(config)#rmon enable

Disable RMON.
Switch(config)#no rmon enable

5.4.5 Typical SNMP Configuration Example

The IP address of the NMS is 1.1.1.5; the IP address of the switch (Agent) is 1.1.1.9
Scenario 1: The NMS network administrative software uses SNMP protocol to obtain data from the switch.
The configuration on the switch is listed below:

Switch(config)#snmp-server enable
Switch(Config)#snmp-server community rw private
Switch(Config)#snmp-server community ro public
Switch(Config)#snmp-server securityip 1.1.1.5

The NMS can use ‘private’ as the community string to access the switch with read-write permission, or use ‘public’ as the community string to access the switch with read-only permission.

Scenario 2: NMS will receive Trap messages from the switch (Note: NMS may have community string verification for the Trap messages. In this scenario, the NMS uses a Trap verification community string of ‘trap’).
The configuration on the switch is listed below:
Switch(config)#snmp-server enable
Switch(Config)#snmp-server host 1.1.1.5 v1 trap
Switch(Config)#snmp-server enable traps

Scenario 3: NMS uses SNMP v3 to obtain information from the switch.
The configuration on the switch is listed below:
Switch(config)#snmp-server enable
Switch (Config)#snmp-server user tester Group encrypted auth md5 hello
Switch (Config)#snmp-server group Group AuthPriv read max write max notify max
Switch (Config)#snmp-server view max 1 include

Scenario 4: NMS wants to receive the v3Trap messages sent by the switch.
The configuration on the switch is listed below:
Switch(config)#snmp-server enable
Switch(config)#snmp-server host 10.1.1.2 v3 AuthPriv tester
Switch(config)#snmp-server enable traps

5.4.6 SNMP Troubleshooting

5.4.6.1 Monitor and Debug Command List

5.4.6.1.1 show snmp

Command: show snmp
Function: Display all SNMP counter information.
Command mode: Admin Mode
Example :
Switch#show snmp
0 SNMP packets input
0 Bad SNMP version errors
0 Unknown community name
0 Illegal operation for community name supplied
0 Encoding errors
0 Number of requested variables
0 Number of altered variables
0 Get-request PDUs
0 Get-next PDUs
0 Set-request PDUs
0 SNMP packets output
0 Too big errors (Max packet size 1500)
0 No such name errors
0 Bad values errors
0 General errors
0 Get-response PDUs
0 SNMP trap PDUs

Displayed information	Explanation
snmp packets input	Total number of SNMP packet inputs.
bad snmp version errors	Number of version information error packets.
unknown community name	Number of community name error packets.
illegal operation for community name supplied	Number of permission for community name error packets.
encoding errors	Number of encoding error packets.
number of requested variablest	Number of variables requested by NMS.
number of altered variables	Number of variables set by NMS.
get-request PDUs	Number of packets received by ‘get’ requests.
get-next PDUs	Number of packets received by ‘getnext’ requests.

set-request PDUs	Number of packets received by ‘set’ requests.
snmp packets output	Total number of SNMP packet outputs.
too big errors	Number of ‘Too_ big’ error SNMP packets.
maximum packet size	Maximum length of SNMP packets.
no such name errors	Number of packets requesting for non-existent MIB objects.
bad values errors	Number of ‘Bad_values’ error SNMP packets.
general errors	Number of ‘General_errors’ error SNMP packets.
response PDUs	Number of response packets sent.
trap PDUs	Number of Trap packets sent.

5.4.6.1.2 show snmp status

Command: show snmp status
Function: Display SNMP configuration information.
Command mode: Admin Mode
Example :
Switch#show snmp status
System Name: DCS-3950-28CT
System Contact: Digital China Networks Limited
System Location: China
Trap disable
RMON enable
Community Information:
Security IP is Enabled
V1/V2c Trap Host Information:
V3 Trap Host Information:

Displayed information	Description
System Name	Switch name
System Contact	Contact mode
System Location	Switch Location
Trap disable	Disable Trap Function
RMON enable	Enable RMON Function
Community Information	Community Information
Security IP is Enabled	Enabled Security IP Function
V1/V2c Trap Host Information	Receive V1/V2c Trap Host Information

V3 Trap Host Information	Receive V3 Trap Host Information

5.4.6.1.3 show snmp engineid

Command: show snmp engineid
Function: Display the engine ID commands
Command mode: Admin Mode
Example:
Switch#show snmp engineid
SNMP engineID: 18c3159876 Engine Boots is:1

Displayed Information	Explanation
SNMP engineID	Engine number
Engine Boots	Engine boot counts

5.4.6.1.4 show snmp user

Command: show snmp user
Function: Display the user information commands
Command mode: Admin Mode
Example:
Switch#show snmp user
User name: initialsha
Engine ID: 1234567890
Auth Protocol: MD5 Priv Protocol:DES-CBC
Row status: active

Displayed Information	Explanation
User name	User name
Engine ID	Engine ID
Priv Protocol	Employed encryption algorithm
Auth Protocol	Employed identification algorithm
Row status	User state

5.4.6.1.5 show snmp group

Command: show snmp group
Function: Display the group information commands
Command mode: Admin Mode
Example :
Switch#show snmp group
Group Name: initial Security Level:noAuthnoPriv
Read View: one

Write View: <no writeview specified>
Notify View: one

Displayed Information	Explanation
Group Name	Group name
Security level	Security level
Read View	Read view name
Write View	Write view name
Notify View	Notify view name
<no writeview specified>	No view name specified by the user

5.4.6.1.6 show snmp view

Command: show snmp view
Function: Display the view information commands.
Command mode: Admin Mode
Example:
Switch#show snmp view
View Name: readview 1. -Included active
1.3. - Excluded active

Displayed Information	Explanation
View Name	View name
1.and1.3.	OID number
Included	The view includes sub trees rooted by this OID
Excluded	The view does not include sub trees rooted by this OID
active	State

5.4.6.1.7 show snmp mib

Command: show snmp mib
Function: Display all MIB supported by the switch
Command mode: Admin Mode

5.4.6.1.8 debug snmp packet

Command: debug snmp packet
no debug snmp packet
Function: Enable the SNMP debugging; the '**no debug snmp packet**' command disables the debugging function
Command mode: Admin Mode

Usage Guide： User can use ‘debug snmp packet’ to enable SNMP debug function and verify debug information to troubleshoot the problems.

Usage Guide： Users can troubleshoot the problems by use ‘debug snmp packet’ to enable SNMP debug function and verify debug information.

Example:

Switch#debug snmp packet

5.4.6.2 SNMP Troubleshooting

When users configure the SNMP, the SNMP server may fail to run properly due to physical connection failure and wrong configuration, etc. Users can troubleshoot the problems by following the guide below:

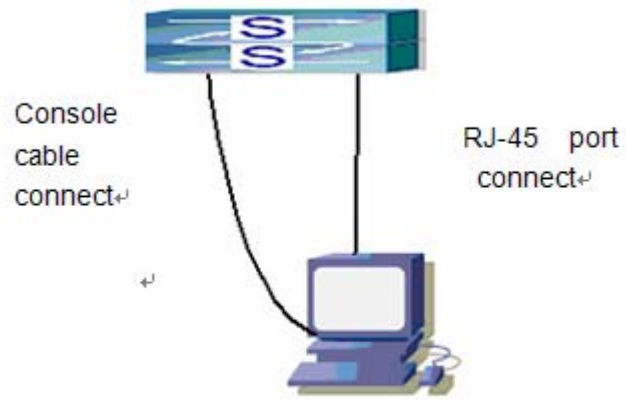
- Good condition of the physical connection.
- Interface and datalink layer protocol is Up (use the ‘show interface’ command), and the connection between the switch and host can be verified by ping (use ‘ping’ command).
- The switch enabled SNMP Agent server function (use ‘snmp-server’ command)
- Secure IP for NMS (use ‘snmp-server securityip’ command) and community string (use ‘snmp-server community’ command) are correctly configured, as any of them fails, SNMP will not be able to communicate with NMS properly.
- If Trap function is required, remember to enable Trap (use ‘snmp-server enable traps’ command). And remember to properly configure the target host IP address and community string for Trap (use ‘snmp-server host’ command) to ensure Trap message can be sent to the specified host.
- If RMON function is required, RMON must be enabled first (use ‘rmon enable’ command).
- Use ‘show snmp’ command to verify sent and received SNMP messages; Use ‘show snmp status’ command to verify SNMP configuration information; Use ‘debug snmp packet’ to enable SNMP debug function and verify debug information.
- If users still can’t solve the SNMP problems, Please contact our technical and service center.

5.5 Switch Upgrade

DCS-3950 series switch provides two ways for switch upgrade: BootROM upgrade and the TFTP/FTP upgrade under Shell

5.5.1 BootROM Upgrade

There are two methods for BootROM upgrade: TFTP and FTP, which can be selected at BootROM command settings.
The upgrade procedures are listed below:



Step 1:
A PC is used as the console for the switch. A console cable is used to connect PC to the management port on the switch. The PC should have FTP/TFTP server software installed and has the img file required for the upgrade.
Step 2:
Press ‘ctrl+b’ on switch boot up until the switch enters BootROM monitor mode. The operation result is shown below:
Testing RAM...
0x00200000 RAM OK

Loading BootRom...
Starting BootRom.....

CPU: 88E6218 133MHZ
BSP version: 1.2.21
Creation date: Mar 12 2007, 10:27:58

Initializing... OK!

[Boot]:

Step 3:
Under BootROM mode, run ‘setconfig’ to set the IP address and mask of the switch under BootROM mode, server IP address and mask, and select TFTP or FTP upgrade. Suppose the switch address is 192.168.1.2/24, and PC address is 192.168.1.66/24, and select TFTP upgrade, the configuration should like:

[Boot]: setconfig

Host IP Address: 10.1.1.1 192.168.1.189
Server IP Address: 10.1.1.2 192.168.1.101
FTP(1) or TFTP(2): 1 2
Network interface configure OK.
[Boot]:

Step 4:
Enable FTP/TFTP server in the PC. For TFTP, run TFTP server program; for FTP, run FTP server program. Before start downloading upgrade file to the switch, verify the connectivity between the server and the switch by ping from the server. If ping succeeds, run 'load' command in the BootROM mode from the switch; if it fails, perform troubleshooting to find out the cause. The following is the configuration for the system update image file.

Loading...
entry = 0x10010
size = 0x1077f8

Step 5:
Execute 'write nos.img' in BootROM mode. The following saves the system update image file.

[Boot]: writeimg
Programming...

Program OK.

Step 6:
After successful upgrade, execute 'run' command in BootROM mode to return to CLI configuration interface.

5.5.2 FTP/TFTP Upgrade

5.5.2.1 Introduction to FTP/TFTP

FTP(File Transfer Protocol)/TFTP(Trivial File Transfer Protocol) are both file transfer protocols that belonging to fourth layer(application layer) of the TCP/IP protocol stack, used for transferring files between hosts, hosts and switches. Both of them transfer files in a client-server model. Their differences are listed below.

FTP builds upon TCP to provide reliable connection-oriented data stream transfer service. However, it does not provide file access authorization and uses simple authentication mechanism (transfers username and password in plain text for authentication). When using FTP to transfer files, two connections need to be established

between the client and the server: a management connection and a data connection. A transfer request should be sent by the FTP client to establish management connection on port 21 in the server, and negotiate a data connection through the management connection.

There are two types of data connections: active connection and passive connection.

In active connection, the client transmits its address and port number for data transmission to the server, the management connection maintains until data transfer is complete. Then, using the address and port number provided by the client, the server establishes data connection on port 20 (if not engaged) to transfer data; if port 20 is engaged, the server automatically generates some other port number to establish data connection.

In passive connection, the client, through management connection, notify the server to establish a passive connection. The server then creates its own data listening port and informs the client about the port, and the client establishes data connection to the specified port.

As data connection is established through the specified address and port, there is a third party to provide data connection service.

TFTP builds upon UDP, providing unreliable data stream transfer service with no user authentication or permission-based file access authorization. It ensures correct data transmission by sending and acknowledging mechanism and retransmission of time-out packets. The advantage of TFTP over FTP is that it is a simple and low overhead file transfer service.

DCS-3950 series switch can operate as either FTP/TFTP client or server. When DCS-3950 series switch operated as a FTP/TFTP client, configuration files or system files can be downloaded from the remote FTP/TFTP servers (can be hosts or other switches) without affecting its normal operation. And file list can also be retrieved from the server in ftp client mode. Of course, DCS-3950 series switch can also upload current configuration files or system files to the remote FTP/TFTP servers (can be hosts or other switches). When DCS-3950 series switch operates as a FTP/TFTP server, it can provide file upload and download service for authorized FTP/TFTP clients, as file list service as FTP server.

Here are some terms frequently used in FTP/TFTP.

ROM: Short for EPROM, erasable read-only memory. EPROM is repalced by FLASH memory in DCS-3950 series switch.

SDRAM: RAM memory in the switch, used for system software operation and configuration sequence storage.

FLASH: Flash memory used to save system file and configuration file

System file: including system image file and boot file.

System image file: refers to the compressed file for switch hardware driver and software support program, usually refer to as IMAGE upgrade file. In DCS-3950 series switch, the system image file is allowed to save in FLASH only. DCS-3950 series switch mandates the name of system image file to be uploaded via FTP in Global Mode to be nos.img, other IMAGE system files will be rejected.

Boot file: refers to the file initializes the switch, also referred to as the ROM upgrade file (Large size file can be compressed as IMAGE file). In DCS-3950 series switch, the boot

file is allowed to save in ROM only. DCS-3950 series switch mandates the name of the boot file to be boot.rom.

Configuration file: including start up configuration file and running configuration file. The distinction between start up configuration file and running configuration file can facilitate the backup and update of the configurations.

Start up configuration file: refers to the configuration sequence used in switch start up. DCS-3950 series switch start up configuration file stores in FLASH only, corresponding to the so called configuration save. To prevent illicit file upload and easier configuration, DCS-3950 series switch mandates the name of start up configuration file to be startup-config.

Running configuration file: refers to the running configuration sequence use in the switch. In DCS-3950 series switch, the running configuration files stores in the RAM. In the current version, the running configuration sequence running-config can be saved from the RAM to FLASH by **write** command or **copy running-config startup-config** command, so that the running configuration sequence becomes the start up configuration file, which is called configuration save. To prevent illicit file upload and easier configuration, DCS-3950 series switch mandates the name of running configuration file to be running-config.

Factory configuration file: The configuration file shipped with DCS-3950 series switch in the name of factory-config. Run **set default** and **write**, and restart the switch, factory configuration file will be loaded to overwrite current start up configuration file.

5.5.2.2 FTP/TFTP Configuration

The configurations of DCS-3950 series switch as FTP and TFTP clients are almost the same, so the configuration procedures for FTP and TFTP are described together in this manual.

5.5.2.2.1 FTP/TFTP Configuration Task List

1. FTP/TFTP client configuration
   （1） Upload/download the configuration file or system file.

   For FTP client, server file list can be checked.
2. FTP server configuration
   （1）Start FTP server
   （2）Configure FTP login username and password
   （3）Modify FTP server connection idle time
   （4）Shut down FTP server
3. TFTP server configuration
   （1） Start TFTP server
   （2） Configure TFTP server connection idle time
   （3） Configure retransmission times before timeout for packets without

acknowledgement

（4） Shut down TFTP server

1. FTP/TFTP configuration

（1）FTP client upload/download file

Command	Explanation
Admin Mode	
copy <***source-url***> <***destination-url***> **[ascii | binary]**	FTP/TFTP client upload/download file
Global Mode	
Dir <ftpServerUrl>	For FTP client, server file list can be checked. *FtpServerUrl* format looks like: ftp: //user: password@IP Address

2. FTP server configuration

（1）Start FTP server

Command	Explanation
Global Mode	
ftp-server enable **no ftp-server enable**	Start FTP server, the '**no ftp-server enable**' command shuts down FTP server and prevents FTP user from logging in.

（2）Set username and password for FTP logging in

Command	Explanation
Global Mode	
ip ftp-server username ***<username>*** **password {0|7}** ***<password>*** **no ip ftp-server username** ***<username>***	Set FTP server 's username and password when logging in.

（3）Modify FTP server connection idle time

Command	Explanation
Global Mode	
ftp-server timeout <seconds> **no ftp-server timeout**	set connection idle time。

3. TFTP server configuration

（1）Start TFTP server

Command	Explanation
Global Mode	
tftp-server enable **no tftp-server enable**	Start TFTP server, the '**no ftp-server enable**' command shuts down TFTP server and prevents TFTP user from logging in.

（2）Modify TFTP server connection idle time

Command	Explanation
Global Mode	
tftp-server transmission-timeout <seconds>	Set maximum retransmission time within timeout interval.

（3）Modify TFTP server connection retransmission time

Command	Explanation
Global Mode	
tftp-server retransmission-number <*number*>	Set maximum retransmission time within timeout interval.

5.5.2.2.2 FTP/TFTP Configuration Command List

5.5.2.2.2.1 copy（FTP）

Command: copy <***source-url*> <*destination-url*> [ascii | binary]**

Function: Download files to the FTP client.

Parameter：<***source-url*>** is the location of the source files or directories to be copied ;**<*destination-url*>** is the destination address to which the files or directories to be copied;forms of <***source-url*>** and **<*destination-url*>** vary depending on different locations of the files or directories. **ascii** indicates the ASCII standard will be adopted;**binary** indicates that the binary system will be adopted in the file transmission （default transmission method）.When URL represents an FTP address, its form should be: ftp://<*username*>:<*password*>@{<*ipaddress*>}/<*filename*>,amongst <*username*> is the FTP user name,<*password*> is the FTP user password,<*ipaddress*>is the IP address of the FTP server/client, <*filename*> is the name of the FTP upload/download file.

Special keywords of the filename:

Keywords	**Source or destination addresses**
running-config	Running configuration files
startup-config	Startup configuration files
nos.img	System files
nos.rom	System startup files

Command mode: Admin Mode

Usage Guide: This command supports command line hints,namely if the user can enter commands in following forms: **copy <*filename*> ftp:**// or **copy ftp:**// **<*filename*>** and press Enter,following hints will be provided by the system：

ftp server ip address [x.x.x.x] >

ftp username>

ftp password>

ftp filename>

Requesting for FTP server address, user name, password and file name.

Examples:

（1）Save images in the FLASH to the FTP server of 10.1.1.1,user name is

Switch,password is Password:

Switch#copy nos.img ftp://Switch:Password@10.1.1.1/nos.img

（2）Obtain system file nos.img from the FTP server 10.1.1.1, user name is Switch,password is Password:

Switch#copy ftp://Switch:Password@10.1.1.1/nos.img nos.img

（3）Save the running configuration files
Switch#copy running-config startup-config
Relative commands: write

5.5.2.2.2.2 dir <ftp-server-url>

Command: dir <*ftp-server*>
Function: Browse the file list on the FTP server.
Parameter： The form of **< ftp-server-url >** is：ftp://<*username*>:<*password*>@<*ipaddress*>,amongst <*username*> is the FTP user name,<*password*> is the FTP user password,
<*ipaddress*> is the IP address of the FTP server.
Command mode: Global Mode

5.5.2.2.2.3 ftp-server enable

Command: ftp-server enable
no ftp-server enable
Function: Start FTP server, the '**no ftp-server enable**' command shuts down FTP server and prevents FTP user from logging in.
Default: FTP server is not started by default.
Command mode: Global Mode
Usage Guide: When FTP server function is enabled, the switch can still perform ftp client functions. FTP server is not started by default.
Example: enable FTP server service.
Switch#config
Switch(Config)# ftp-server enable
Relative commands: ip ftp-server username

5.5.2.2.2.4 ftp-server timeout

Command: ftp-server timeout <*seconds*>
no ftp-server timeout
Function: Set data connection idle time, If **no** is put in front of this command, default values will be recovered.
Parameter: < *seconds*> is the idle time threshold (in seconds) for FTP connection, the valid range is 5 to 3600.

Default: The system default is 600 seconds.
Command mode: Global mode
Usage Guide: When FTP data connection idle time exceeds this limit, the FTP management connection will be disconnected.
Example: Modify the idle threshold to 100 seconds.
Switch#config
Switch(Config)#ftp-server timeout 100

5.5.2.2.2.5 ip ftp-server username

Command: ip ftp-server username <*username*> password {0|7} <*password*>
no ip ftp-server username <*username*>
Function: Configure the user name and password for ftp access. If no is put in front of this command, user name and password will be removed.
Parameters: <user-name> is the user name for FTP access, with its length limited up to 16 characters. For **0|7**, **0** is for no encryption of passwords, while **7** for encryption. <password> is the password for FTP access, with its length limited up to 16 characters.
Default: The default password for the system is **username@Switchname.domain**. **username** is the current user name, and **Switchname** is the name of the switch, and **domain** is the domain name of the switch.
Command mode: Global Mode
Example: Configure the user name for FTP access to be Switch, and the password to be digitalchina.
Switch#config
Switch(Config)# ip ftp-server username Switch password 0 digitalchina

5.5.2.2.2.6 copy（TFTP）

Command: copy <***source-url*> <*destination-url*> [ascii | binary]**
Function: Download files to the TFTP client
Parameter：<***source-url*>** is the location of the source files or directories to be copied; ***<destination-url>*** is the destination address to which the files or directories to be copied;forms of <***source-url*>** and ***<destination-url>*** vary depending on different locations of the files or directories. **ascii** indicates the ASCII standard will be adopted;**binary** indicates that the binary system will be adopted in the file transmission（default transmission method）.When URL represents an TFTP address, its form should be: tftp://<*ipaddress*>/<*filename*>,amongst <*ipaddress*> is the IP address of the TFTP server/client, <*filename*> is the name of the TFTP upload/download file.
Special keyword of the filename：

Keywords	Source or destination addresses
running-config	Running configuration files
startup-config	Startup configuration files
nos.img	System files
nos.rom	System startup files

Command mode: Admin Mode

Usage Guide: This command supports command line hints,namely if the user can enter commands in following forms: **copy <*filename*> tftp:**// or **copy tftp:**// **<*filename*>** and press Enter,following hints will be provided by the system：
tftp server ip address>
tftp filename>
Requesting for TFTP server address, file name
Example:
(1) Copy the system image in the flash to TFTP server at 10.1.1.1.
Switch#copy nos.img tftp:// 10.1.1.1/ nos.img
(2) Copy the image named nos.img from TFTP server at 10.1.1.1
Switch#copy tftp://10.1.1.1/nos.img nos.img

(3) Save the configuration file to flash.
Switch#copy running-config startup-config
Relative commands：write

5.5.2.2.2.7 tftp-server enable

Command：tftp-server enable
no tftp-server enable
Function: Enable the TFTP server. If no is put in front of this command, TFTP service will be disabled.
Default: TFTP server is disabled by default.
Command mode: Global Mode
Usage Guide: When TFTP server is enabled, the switch can also be used as a TFTP client. The TFTP server is disabled by default.
Example: Enable the TFTP service.
Switch#config
Switch(Config)#tftp-server enable
Relative Commands：tftp-server timeout

5.5.2.2.2.8 tftp-server retransmission-number

Command: tftp-server retransmission-number <*number*>
Function: Configure the retry limits for the TFTP data transmition.
Parameters: <number> is the maximum retry times, which is limited between 1 and 20.
Default: The default retry limit is set to 5.
Command mode: Global Mode.
Example: Change the retry limit to 10.
Switch#config
Switch(Config)#tftp-server retransmission-number 10

5.5.2.2.2.9 tftp-server transmission-timeout

Command: tftp-server transmission-timeout <*seconds*>
Function: Configure the timeout for TFTP data transmission.

Parameters: <seconds> is the timeout value in seconds, which is limited between 5 and 3600 seconds.
Default: The default timeout is set to 600s.
Command mode: Global Mode.
Example: Change the timeout to be 60s.
Switch#config
Switch(Config)#tftp-server transmission-timeout 60

5.5.2.3 FTP/TFTP Configuration Example

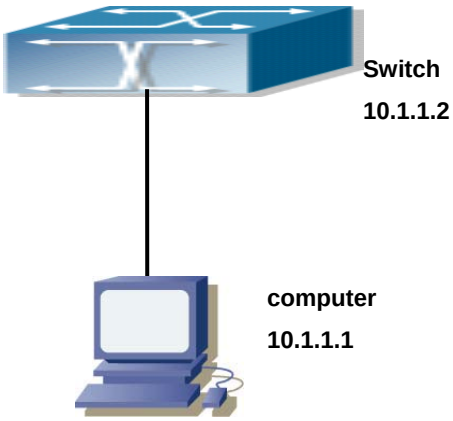


Fig 5-2 Download nos.img file as FTP/TFTP client

Scenario 1: The switch is used as FTP/TFTP client. The switch connects from one of its ports to a computer, which is a FTP/TFTP server with an IP address of 10.1.1.1; the switch acts as a FTP/TFTP client, the IP address of the switch management VLAN is 10.1.1.2. Download 'nos.img' file in the computer to the switch.

- **FTP Configuration**

PC side:

Start the FTP server software on the computer and set the username 'Switch', and the password 'switch'. Place the 'nos.img' file to the appropriate FTP server directory on the computer.

DCS-3950:

Switch(Config)#inter vlan 1
Switch (Config-If-Vlan1)#ip address 10.1.1.2 255.255.255.0
Switch (Config-If-Vlan1)#no shut
Switch (Config-If-Vlan1)#exit
Switch (Config)#exit
Switch#copy ftp: //Switch:switch@10.1.1.1/12_30_nos.img nos.img
Switch#reload

With the above commands, the switch will have the 'nos.img' file in the computer downloaded to the FLASH.

- **TFTP Configuration**

PC side:

Start TFTP server software on the computer and place the ‘nos.img’ file to the appropriate TFTP server directory on the computer.
DCS-3950:
Switch (Config)#inter vlan 1
Switch (Config-If-Vlan1)#ip address 10.1.1.2 255.255.255.0
Switch (Config-If-Vlan1)#no shut
Switch (Config-If-Vlan1)#exit
Switch (Config)#exit
Switch#copy tftp: //10.1.1.1/nos.img nos.img
Switch#reload

Scenario 2: The switch is used as FTP server. The switch operates as the FTP server and connects from one of its ports to a computer, which is a FTP client. Transfer the ‘nos.img’ file in the switch to the computer and save as 12_25_nos.img.
The configuration procedures of the switch is listed below:
Switch (Config)#inter vlan 1
Switch (Config-If-Vlan1)#ip address 10.1.1.2 255.255.255.0
Switch (Config-If-Vlan1)#no shut
Switch (Config-If-Vlan1)#exit
Switch (Config)#ftp-server enable
Switch(Config)# username Switch password 0 Password
PC side:
Login to the switch with any FTP client software, with the username ‘Switch’ and password ‘Password’, use the command ‘get nos.img nos.img’ to download ‘nos.img’ file from the switch to the computer.

Scenario 3: The DCS-3950 is used as TFTP server. The switch operates as the TFTP server and connects from one of its ports to a computer, which is a TFTP client. Transfer the ‘nos.img’ file in the switch to the computer.
The configuration procedures of the switch is listed below:
DCS-3950:
Switch(Config)#inter vlan 1
Switch (Config-If-Vlan1)#ip address 10.1.1.2 255.255.255.0
Switch (Config-If-Vlan1)#no shut
Switch (Config-If-Vlan1)#exit
Switch (Config)#tftp-server enable
PC side:
Login to the DCS-3950 with any TFTP client software, use the ‘tftp’ command to download ‘nos.img’ file from the switch to the computer.

Scenario 4: The DCS-3950 is used as FTP server. The switch operates as the FTP server and connects from one of its ports to a computer, which is a FTP client. Transfer the ‘nos.img’ file in the switch to the computer. The configuration procedures of the switch is listed below:

DCS-3950:
Switch(Config)#inter vlan 1
Switch(Config-If-Vlan1)#ip address 10.1.1.2 255.255.255.0
Switch(Config-If-Vlan1)#no shut
Switch(Config-If-Vlan1)#exit
Switch(Config)#ftp-server enable
Switch(Config)# ip ftp-server username Switch password 0 Password
PC side:
Start the FTP server software on the PC and set the username ‘Switch’, and the password ‘Password’,use the IS or DIR command:
C:\>ftp 10.1.1.2
Connected to 10.1.1.2.
220 welcome your using ftp server...
User (10.1.1.2:(none)): Switch
331 User name okay,need password
Password:
230 User logged in,proceed
ftp> dir
200 PORT Command successful
150 ascii type in transfer file
file name file length
nos.img 1195841
nos.rom 557980
startup-config 2611
running-config
226 transfer complete.
ftp: 137 bytes received in 0.08Seconds 1.73Kbytes/sec.
ftp>ls
200 PORT Command successful
150 ascii type in transfer file
file name file length
nos.img 1195841
nos.rom 557980
startup-config 2611
running-config
226 transfer complete.
ftp: 137 bytes received in 0.08Seconds 1.73Kbytes/sec
ftp>

Scenario 5: The DCS-3950 switch acts as FTP client to view file list on the FTP server. Synchronization conditions: The switch connects to a computer by an Ethernet port, the computer is a FTP server with an IP address of 10.1.1.1; the switch acts as a FTP client, and the IP address of the switch management VLAN1 interface is 10.1.1.2.

FTP Configuration

PC side:
Start the FTP server software on the PC and set the username ‘Switch’, and the password ‘Password’.
DCS-3950：
Switch(Config)#inter vlan 1
Switch(Config-If-Vlan1)#ip address 10.1.1.2 255.255.255.0
Switch(Config-If-Vlan1)#no shut
Switch(Config-If-Vlan1)#exit
Switch(Config)#dir ftp://Switch:Password@10.1.1.1
220 Serv-U FTP-Server v2.5 build 6 for WinSock ready...
331 User name okay, need password.
230 User logged in, proceed.
200 PORT Command successful.
150 Opening ASCII mode data connection for /bin/ls.
recv total = 480
nos.img
nos.rom
parsecommandline.cpp
position.doc
qmdict.zip
shell maintenance statistics.xls
…(some display omitted here)
show.txt
snmp.TXT
226 Transfer complete.
Switch(Config)#

5.5.2.4 FTP/TFTP Troubleshooting

5.5.2.4.1 Debugging Command List

5.5.2.4.1.1 show ftp

Command: show ftp
Function: Show configuration parameters of FTP server.
Command mode: Admin Mode.
Default: This command is disabled by default.
Example:
Switch#sh ftp

timeout :60

Parameters	Descriptions

timeout	Time for the timeout timer.
Retry Times	Number of times to retries to retransmit data packets.

5.5.2.4.1.2 show tftp

Command: show tftp
Function: TShow configuration of TFTP server.
Default: TFTP debug information is disabled by default.
Command mode: Admin Mode
Example:
Switch#sh tftp

timeout :60
Retry Times :10

Parameters	Description
Timeout	Time out for timer
Retry Times	Retry times.

5.5.2.4.2 FTP Troubleshooting

When upload/download system file with FTP protocol, the connectivity of the link must be ensured, i.e., use the '**Ping**' command to verify the connectivity between the FTP client and server before running the FTP program. If ping fails, you will need to check for appropriate troubleshooting information to recover the link connectivity.

☞ The following is what the message displays when files are successfully transferred. Otherwise, please verify link connectivity and retry 'copy' command again.

220 Serv-U FTP-Server v2.5 build 6 for WinSock ready...
331 User name okay, need password.
230 User logged in, proceed.
200 PORT Command successful.
nos.img file length = 1526021
read file ok
send file
150 Opening ASCII mode data connection for nos.img.
226 Transfer complete.
close ftp client.

☞ The following is the message displays when files are successfully received. Otherwise, please verify link connectivity and retry 'copy' command again.

220 Serv-U FTP-Server v2.5 build 6 for WinSock ready...
331 User name okay, need password.
230 User logged in, proceed.
200 PORT Command successful.
recv total = 1526037
****

write ok
150 Opening ASCII mode data connection for nos.img (1526037 bytes).
226 Transfer complete.

☞ If the switch is upgrading system file or system start up file through FTP, the switch must not be restarted until ‘close ftp client’ or ‘226 Transfer complete.’ is displayed, indicating upgrade is successful, otherwise the switch may be rendered unable to start. If the system file and system start up file upgrade through FTP fails, please try to upgrade again or use the BootROM mode to upgrade.

5.5.2.4.3 TFTP Troubleshooting

When upload/download system file with TFTP protocol, the connectivity of the link must be ensured, i.e., use the ‘**Ping**’ command to verify the connectivity between the TFTP client and server before running the TFTP program. If ping fails, you will need to check for appropriate troubleshooting information to recover the link connectivity.

☞ The following is the message displays when files are successfully transferred. Otherwise, please verify link connectivity and retry ‘copy’ command again.

```
nos.img file length = 1526021
read file ok
begin to send file,wait...
file transfers complete.
close tftp client.
```

☞ The following is the message displays when files are successfully received. Otherwise, please verify link connectivity and retry ‘copy’ command again.

```
begin to receive file,wait...
recv 1526037
************************
write ok
transfer complete
close tftp client.
```

If the switch is upgrading system file or system start up file through TFTP, the switch must not be restarted until ‘close tftp client’ is displayed, indicating upgrade is successful, otherwise the switch may be rendered unable to start. If the system file and system start up file upgrade through TFTP fails, please try upgrade again or use the BootROM mode to upgrade

5.6 System Log

5.6.1 Introduction to the System Log

System log takes control of the output of most information and is able to effectively

filter the information because of its ability to do fine-grain classification. Its combination with Debug program provides a powerful support for the network managers and developers to monitor the operation of network and diagnose the problems of network.

The system log of Digital China switch has the following features:

- Support the system log output in four directions: Console, Telnet terminal and Dumb terminal（monitor）, logbuf, and loghost.
- The log information can be divided into four levels according to different importance, and thus can be filtered by level.
- The log information can be divided according to different source modules, and thus can be filtered by module.

5.6.1.1 Log Output Channel

At present, the system log of Digital China switch can be outputted through five directions(aka log channels)：

- Output log information to local console through Console port.
- Output log information to remote Telnet terminal or Dumb terminal, which helps remote maintenance.
- Allocate log buffer of proper size inside the switch to record log information.
- Configure loghost. The log system will directly send log information to loghost, and save it in the form of file in the loghost so the information can be reviewed on demand.

5.6.1.2 Format and Severity of the Log Information

The log information format is compatible with the 4.3 BSD UNIX syslog protocol, so we can record and analyze the log by the systlog (system log protect session) on the UNIX/LINUX, as well as syslog similar applications on PC.

The log information is classified into eight classes by severity or emergency procedure. One level per value and the higher the emergency level the log information has, the smaller its value will be. For example, the level of critical is 2, and warning is 4, debugging is leveled at 7, so the critical is higher than warnings which no doubt is high than debugging.

Severity	Value	Description	Syslog define
critical	2	Critical conditions	LOG_CRIT
warnings	4	Warning conditions	LOG_WARNING
notifications	5	Normal but significant condition	LOG_NOTICE
debugging	7	Debugging messages	LOG_DEBUG

Right now the switch can generate information of following two levels

- Up/down switch, topology change, aggregate port state change of the interface are classified warnings
- The display level of the output monitored by shell Configure command is notifications.

Attention：By default the system log is disabled. When it is enabled, because of the classification and output of the information, especially when there is a large amount of information under processing, the system performance will be affected.

5.6.1.3 The three-level switch of log message

The system log uses three-level switch architecture to control the output of the log message: global log switch, log output channel state and the module state of channel filter Items.

- Only when the global switch is on, the log message is written to the log message queue.
- After the switch boots, the system log task is started. The aim of this task is to read out every log message from the log message queue, and to send them out through every output channel. Only when the output channel is in 'Enable' state, the log message can be sent out through it.

When the log message enters the output channel, it will be checked according to the output channel's filter items, only when the source module of the log message is marked as 'On' in the filter items, the log message can be actually sent out through the output channel.

5.6.2 System Log Configuration

5.6.2.1 System Log Configuration Task List

1. Set the global log switch
2. Set the output channel of the console.
3. Set the output channel of the user's terminal
4. Set the output channel of the log buffer
5. Set the output channel of the log host
6. Display the information of the log channel
7. Set the filter items of the log output channel.

1. Set the global log switch

Command	Description
Privileged configuration mode	
logging on **no logging on**	Enable the global log function. Prefixing the command with a 'no' will disable this function.

1. 2. Set the output channel of the console

Command	Description
Privileged configuration mode	
logging console **no logging console**	Open the output channel of the console. Prefixing the command with a 'no' will disable

	this function.

3. Set the output channel of the user's terminal

Command	Description
Privileged configuration mode	
logging monitor **no logging monitor**	Open the output channel of the user's terminal. Prefixing the command with a 'no' will disable this function.

4. Set the output channel of the log buffer

Command	Description
Privileged configuration mode	
logging buffered [<*buffersize* >] **no logging buffered**	Open the output channel of the log buffer. Prefixing the command with a 'no' will disable this function.
show logging buffered [< ***buffersize*** **>]**	Display detailed information of the channel of the log buffer
clear logging	Clear the information in the log buffer.

5. Set the output channel of the log host

Command	Description
Privileged configuration mode	
logging <*ip-addr*> [facility <*local-number*>] **no logging <*ip-addr*>**	Open the output channel of the log host. Prefixing the command with a 'no' will disable this function.

6. Display the information of the log channel

Command	Description
Privileged configuration mode	
show channel [console | monitor | logbuff | loghost]	Display the information of the log channel

7. Set the filter items of the log output channel.

Command	Description
Privileged configuration mode	
logging source {<*modu-name*>| default } channel <*channel-name*> [level <severity> [state { on | off }]] **no logging source { <*modu-name*> | default } channel <*channel-name*>**	Add filter items to the output channel of the log. Delete filter items from the output channel of the log..

5.6.2.2 Sys log Command list

5.6.2.2.1 clear logging

Command: clear logging
Function: Log in the log buffers can be cleared through this command.
Command mode: Admin Mode

Usage Guide: This command is used to clear all the information in the log buffer zone.
Example: Clear all the logs in the log buffer.
Switch# clear logging
Relative Commands: show logging buffered

5.6.2.2.2 logging buffered

Command: logging buffered [<*buffersize*>]
no logging buffered
Function: This command is used to enable the memory buffer as output path for logs. If no is put in front of the command, this command will be disabled.
Parameters: <*buffersize*> is the size for the log buffer, in number of lines the buffer can store. The buffer size is limited between 10 and 1000.
Command mode: Global Mode.
Default: Logs will not be stored in the memory buffer by default. If logging buffer is enabled, the default size of the buffer is 100 lines.
Usage Guide: This command will take effect only if the global logging system is enabled.
Example: To configure the logging to be stored in memory buffers, and set the size of the memory buffers to be 50.
Switch(Config)# logging buffered 50
Relative Commands: logging on，show channel logbuff，show logging buffered

5.6.2.2.3 logging console

Command: logging console
no logging console
Function: This command will configure the console port as the output for the logging informations. If no is put in front of the command, it will be disabled.
Command mode: Admin Mode
Default: Logging information will not be output to the console port by default.
Usage Guide: This command can take effect only if the global logging system is enabled.
Example: Enable the console port as the output for logging information.
Switch#logging console
Relative Commands: logging on，show channel console

5.6.2.2.4 logging host

Command: logging <*ip-addr*> [facility <*local-number*>]

no logging *<ip-addr>*

Function: This command is used to enable certern hosts to be output channel for logging information. If no is put in front of the command, logging host configurations will be removed.

Parameters: *<ip-addr>* is the IP address for the host to receive the logs.

<local-number> is the recording equipment of the host with a valid range of local0～local7.

Command mode: Admin Mode

Default: No log information output to the log host by default. The default recorder of the log host is the local0.

Usage Guide: Only when the log host is configured by the logging command, this command can be available.

Example: Send the log information to the log server with an IP address of 100.100.100.5, and save to the log recording equipment local1

Switch# logging 100.100.100.5 facility local1

Relative Commands: logging on，show channel loghost

5.6.2.2.5 logging monitor

Command: logging monitor

no logging monitor

Function: This command is used to enable user's monitor as the output of the logging information. If no is put in front of this command, logging will be disabled.

Command mode: Admin Mode

Default: Logging information output to user monitor will be disabled by default.

Usage Guide: This command will take effect only if the global logging is enabled.

Example: To configure the user monitor as the output for the logging information.

Switch# logging monitor

Relative Commands: logging on，show channel monitor

5.6.2.2.6 logging on

Command: logging on

no logging on

Function: This command is used to enable the global logging information. If no is put in front of this command, it will be disabled.

Command mode: Global Mode.

Default: Global logging will be disabled by default.

Usage Guide: Logging information can be delivered to hosts, the console port only if the global logging information is enabled.

Example: Enable the global logging system.

Switch(Config)# logging on

Relative Commands: logging host，logging buffered，logging console，logging monitor，show logging buffered

5.6.2.2.7 logging source

Command: logging source {default|m_shell|sys_event} channel {console|logbuff| loghost|monitor} [level {critical|debugging|notifications|warnings} [state {on|off}]]
no logging source {default|m_shell|sys_event} channel {console|logbuff| loghost|monitor }
Function: This command is used to add or remove logging source path.

Parameters: m_shell is used to enable shell for logging output path. **sys_event** is used to enable logging for important system events, including ports up/down events, topology changes. **default** is used to enable logging for all the software modules. channel **(console | logbuff | loghost | monitor)** is the output path for logging. **console** for the console port, **monitor** for the user monitor, **logbuf** for the memory buffer, and **loghost** for remote logging host. **level (critical | debugging | notifications | warnings)** configures the logging level. **state { on | off }** is used to enable or disable the logging.

Logging levels are defined as below:

critical	- critical logs
debugging	- logs for debugging purpose.
notifications	- Important information.
warnings	- Warning logs.

Command mode: Admin Mode
Default: Logging is delivered to logbuffer by default, with logging level as debugging.
Usage Guide: This command is used to filter logging information at the modules' level. For example, the logging for the Driver module can be configured to output to any supported output path. For logs with its level higher than warnings can be configured to output to hosts, while logs of lower levels than notifications can be configured to output to logbuf.

Notice: There only two modules available for the source at the time when the manual is written. They are:
One is m_shell for logging for all the configuration commands, the log level is notifications. And the other is sys_event, which is used to monitor all the system events, including UP/DOWN, STP topology changes, and the state changes of trank ports. The loglevel is warnings.
Example: Enable logging for the shell module for logs that are delivered to loghost.l And enable the logging level to be notifications. Enable logging of the shell module to the logbuff, with the logging level to be debugging.
Switch(Config)# logging source m_shell channel loghost level notifications state on
Switch(Config)# logging source m_shell channel logbuff level debugging state on
Relative Commands: logging on，logging console，logging monitor，logging host，logging buffered

5.6.3 System Log Configuration Example

When managing VLAN the IPv4 address of the switch is 100.100.100.1, and the IPv4 address of the remote log server is 100.100.100.5. It is required to send the log information with a severity equal to or higher than warnings to this log server and save in the log record equipment local1, Output the log information of a module shell if its Severity Level is warning or critical.

configure:
Switch(Config)#logging on↵
Switch(Config)#logging 100.100.100.5 facility local1↵
Switch(Config)#logging source m_shell channel loghost level debugging state on↵
Switch(Config)#logging source sys_event channel loghost level debugging state on↵
Switch(Config)#logging logbuffed 1000↵
Switch(Config)#logging source m_shell channel logbuff level warning state on↵

5.6.4 System Log troubleshooting

5.6.4.1 Monitor and Debug Command List

5.6.4.1.1 show channel

Command：show channel [console | monitor | logbuff | loghost]
Function：Display brief information of the log channel.
Parameters： console the output channel of log is console; monitor the output channel of log is the user's terminal; logbuff the output channel of log is the log buffer；loghost the output channel of log is the log host.
Command mode：Privileged configuration mode.
Default Setting：**show channel** will display the brief information of all the channels without any parameter.
Usage Guide: This command can be used to view logs from some certain logging path.
Example: View the logs in loghost.
Switch# show channel loghost↵
/********* Loghost Channel ***************/
Channel ID:2, channel name:loghost
State: On
Send messages:0,Dropped messages:0

Loghosts:
IPAddress Facility
100.100.100.5 local1

Filter Items:
Module State Servirity
shell On debugging
Relative Command：logging on

5.6.4.1.2 show logging buffered

Command：show logging buffered [<*buffersize*>]
Function：Display detailed information of the channel of the log buffer
Parameters：*<buffersize>* is the number of the log message to display
Command mode：Privileged configuration mode.
Default Setting：100 log messages will be displayed without any parameter.
Usage Guide: If the actual pices of logging information is less than ***<buffersize>,*** the actual pieces of logging information will be displayed.
Example: Display the most recent 20 items of logs in the log buffer.
Switch# show logging buffered 20
/********* Logbuff Channel ***************/
Channel ID:3, channel name:logbuff
State: On
Allowed max messages:100,Dropped messages:0,Current messages:0

Filter Items:
Module State Servirity
Driver On debugging

Msgs:
1. IFNET-5-UPDOWN:Line protocol on interface GigabitEthernet0/1/1, changed state to UP
2. EXEC-5-LOGIN: Console login from Console0
Relative Command：logging on，show channel logbuff

5.6.4.1.3 show logging lastFailureInfo

Command：show logging lastFailureInfo
Function：Display the abnormal information recorded in the flash
Command mode：Privileged configuration mode.
Example:
Switch# show logging lastFailureInfo
Relative Command：erase logging lastFailureInfo

5.6.4.1.4 erase logging lastFailureInfo

Command：erase logging lastFailureInfo
Function：Erase the abnormal information recorded in the flash

Command mode：Privileged configuration mode.
Example:
Switch# erase logging lastFailureInfo
Relative Command：show logging lastFailureInfo

5.6.4.2 System Log troubleshooting

Please check the following causes if any problem happens when using the system log：

- ✧ Check if the global log switch is on.
- ✧ Use the show channel command in the privileged mode to check the state of each channel and the state of the modules in filter items.

5.7 Classified Configuration

5.7.1 Introduction of Classified Configuration

In order to effectively protect the network, the switch allows users to log on as different identities to configure it, allows different password for those identities, and allows those identities to use different rights, when configuring the switch. Right now, DCN switch provides visitor and admin as configuration levels. Their differences are listed as follows:

Identity to Log On	Configuration Rights
visitor	Most of show command and ping, traceroute, clear etc.. config mode is not allowed on this level
admin	All of the commands.

5.7.2 Configure the Classified Configuration

5.7.2.1 Classified Configuration Task List

1. Command to enable privileged mode.
2. Set the corresponding password for the identity to log on.

1. Command to enable privileged mode

Command	Explanation
Enable [level { visitor | admin } [<*password*>]]	To log to the switch in the specified identity

2. Set the corresponding password for the identity to log on.

Command	Explanation

enable password level {visitor|admin}	To set the password for logging to the configuration mode.

5.7.2.2 Classified Configuration Command list

5.7.2.2.1 Enable

Command: Enable [level {visitor|admin} [<*password*>]]
Function: Specify the security level for a user to access the switch, guest vistor or administrator.
Parameters: <password> is the corresponding password.
Command mode: Normal user mode
Default: switch is accessed as admin by default.
Usage Guide: If the password is set, but not input when login, password will have to be entered through interactive interface.
Example: Enable the admin configuration mode with visitor identity, and password is Password.
Method 1:
SWITCH>enable level visitor SWITCH
SWITCH#
Method 2:
SWITCH >enable level visitor
Password:*** <----------Input Password
SWITCH#

5.7.2.2.2 Enable password level

Command: Enable password level {visitor|admin}
Function: Enable passwords for configuration login
Command mode: Global Mode.
Default: No password is configured by default.
Usage Guide: With this command, users will be interactively prompted to input current password, the new password, and the confirmation. Password can be set to empty in order to disable the passwords.
Example: Set the password of vistor to be Password
switch(config)#enable password level visitor
Current password:
New password:*** <---------- Password
Confirm new password:*** <---------- Password

5.7.2.2.3 No enable password level

Command: no enable password level {visitor|admin} [<*enable_password*>]

Function: Disable the passwords
Command mode: Global Mode.
Parameters: <*enable_password*> is the password to be removed.
Default: None
Usage Guide: if <*enable_password*> is not configured, and the password to be deleted is for the ***admin*** user, then interactive dialog will be entered. If the password to be deleted belongs to ***visitor***, the **<*enabled_password*>** option can be obmitted.
Example, Remove the password for the ***admin*** user, which is ***Password***.
switch(config)#no enable password level admin
Input password:*** <----------Input Password here.

5.8 Port Isolation

5.8.1 Introduction of Port Isolation

Port isolation is aimed at meeting the user's demand showed below:

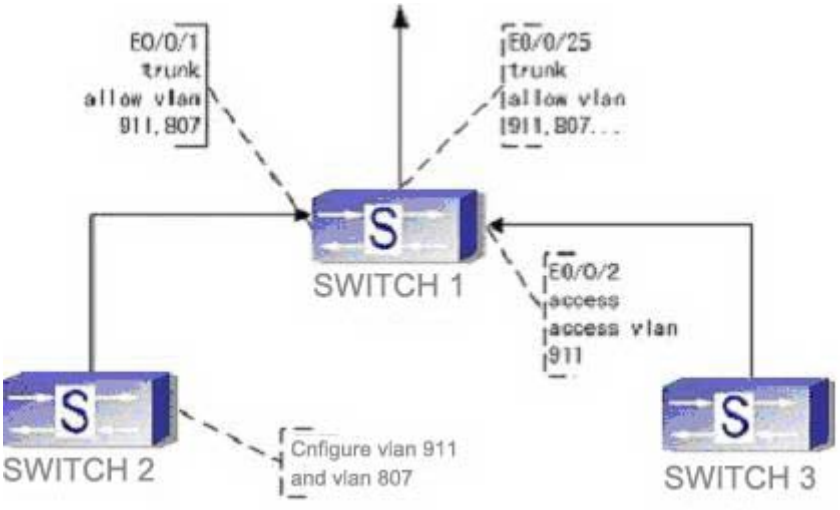


Fig 5-3 the topologic structure of the switches

The topologic structure of the switches is illustrated in the picture above. The demand is that, once the configuration port on switch1 is isolated, the e0/0/1 and e0/0/2 on switch1 are not connected, while both of which can be connected to the uplink port e0/0/25. That is all the downlink ports can not connect to each other, but a downlink port can be connected to a specified uplink port. The uplink port can be connected to any port.

5.8.2 Port Isolation Configuration

5.8.2.1 Port isolation configuration Task List

1. Set the uplink port

Command	Explanation
isolate-port allowed ethernet <*InterfaceList*> **no isolate-port allowed [ethernet <*InterfaceList*>]**	Enable or disable the port isolation function. A uplink port list is needed to enable it. This command can be called more than once to set or cancel uplink ports.

5.8.2.2 Isolating Interfaces

Command: isolate-port allowed ethernet <*InterfaceList*>
no isolate-port allowed [ethernet <*InterfaceList*>]

Function: Enable or disable the isolation of interfaces. Upward interfaces should be specified when the interface isolation is enabled. This command can be invoked repeatedly, to enable or disable every upward interface.

Parameters: <*InterfaceList*> is the list for the upward interfaces, which is separated by '-' or ';'.

Command mode: Global Mode.

Default: Interface isolation is disabled by default.

Usage Guide:

1. Interface isolation will be enabled once the upward interfaces are enabled. As a result, all the interfaces except upward interfaces can not communicate with each other. But for upward interfaces, it can communicate with other interfaces.
2. When the upward interfaces are disabled, the interface isolation will be disabled. Then all the interfaces can communicate with each other.
3. Mostly fast ethernet interfaces are configured as downward interfaces. If the fast ethernet interfaces are configured as upward interfaces, the configuration will take effect for 8 interfaces as a unit, If ethernet 0/0/1 is configured to be upward interface, then ethenet 0/0/1~8 will be upward. If ethernet 0/0/1 is configured to be downward port, then the ethernet 0/0/1~8 will be isolated.

Example: Configure ethernet 0/0/25 and ethernet 0/0/26 as upward, and all the other ports are isolated.

Chapter 6 Cluster Configuration

6.1 Introduction to Cluster Network Management

Cluster network management is an in-band configuration management. Unlike CLI, SNMP and Web Config which implement a direct management of the target switches through a management workstation, cluster network management implements a direct management of the target switches (member switches) through an intermediate switch (commander switch). A commander switch can manage multiple member switches. As soon as a Public IP address is configured in the commander switch, all the member switches which are configured with private IP addresses can be managed remotely. This feature economizes public IP addresses which are short of supply. Cluster network management can dynamically discover cluster feature enabled switches (candidate switches). Network administrators can statically or dynamically add the candidate switches to the cluster which is already established. Accordingly, they can configure and manage the member switches through the commander switch. When the member switches are distributed in various physical locations (such as on the different floors of the same building), cluster network management has obvious advantages. Moreover, cluster network management is an in-band management. The commander switch can communicate with member switches in existing network. There is no need to build a specific network for network management.

Cluster network management has the following features:

- Save IP addresses
- Simplify configuration tasks
- Indifference to network topology and distance limitation
- Auto detecting and auto establishing
- With factory default settings, multiple switches can be managed through cluster network management
- The commander switch can upgrade and configure any member switches in the cluster

6.2 Cluster Network Management Configuration

6.2.1 Cluster Network Management Configuration Task List

1. Enable or disable cluster function
2. Create cluster
   1) Create or delete cluster
   2) Configure private IP address pool for member switches of the cluster
   3) Add or remove a member switch
3. Configure attributes of the cluster in the commander switch
   1) Enable or disable joining the cluster automatically
   2) Set holdtime of heartbeat of the cluster
   3) Set interval of sending heartbeat packets among the switches of the cluster
   4) Clear the list of candidate switches discovered by the commander switch
4. Configure attributes of the cluster in the candidate switch
   1) Set interval of sending cluster register packet
5. Remote cluster network management
   1) Remote configuration management
   2) Reboot member switch
   3) Remotely upgrade member switch

1. Enable or disable cluster

Command	Explanation
Global Mode	
cluster run **no cluster run**	Enable or disable cluster function in the switch

2. Create a cluster

Command	Explanation
Global Mode	
cluster commander <*cluster-name*> ***[vlan<vlan-id>]*** **no cluster commander**	Create or delete a cluster
cluster ip-pool<*commander-ip*> **no cluster ip-pool**	Configure private IP address pool for member switches of the cluster
cluster member {candidate-sn <*cand-sn*> | **mac-address <*mac-add*>** **[<*mem-id*>] }[password <*pass*>]** **no cluster member < *mem-id* >**	Add or remove a member switch

3. Configure attributes of the cluster in the commander switch

Command	Explanation
Global Mode	

cluster auto-add enable **no cluster auto-add enable**	Enable or disable adding newly discovered candidate switch to the cluster
cluster holdtime < second> **no cluster holdtime**	Set holdtime of heartbeat of the cluster
cluster heartbeat <*interval*> **no cluster heartbeat**	Set interval of sending heartbeat packets among the switches of the cluster
clear cluster candidate-table	Clear the list of candidate switches discovered by the commander switch

4. Configure attributes of the cluster in the candidate switch

Command	Explanation
Global Mode	
cluster register timer <*timer-value*> **no cluster register timer**	Set interval of sending cluster register packet

5. Remote cluster network management

Command	Explanation
Admin Mode	
rcommand member <mem-id>	In the commander switch, this command is used to configure and manage member switches.
rcommand commander	In the member switch, this command is used to configure the member switch itself.
cluster reset member<mem-id>	In the commander switch, this command is used to reset the member switch.
cluster update member <*mem-id*> **<*src-url*> <*dst-url*> [ascii | binary]**	In the commander switch, this command is used to remotely upgrade the member switch.

6.2.2 Clustering Configuration Command List

6.2.2.1 cluster run

Command: cluster run
no cluster run
Function: Enable the clustering mode. While no is to disable the command.
Parameters: None.
Command mode: Global Mode.
Default: Clustering is enabled by default.
Usage Guide: This command is used to start the clustering service. Clustering commands can be configured only if clustering is disabled.
Example: Disable the clustering service on the switch.

Switch (Config)#no cluster run

6.2.2.2 cluser register timer

Command: cluster register timer <*time-value*>
no cluster register timer
Function: Set interval of sending cluster register packet, the '**no cluster register timer**' command restores the default setting.
Parameters:
<*timer-value*>valid range is 30 to 65535 in seconds,.
Command mode: Global Mode.
Default: Cluster register timer is 60 seconds by default.
Usage Guide*: <timer-value>* is interval of sending cluster register packet.
Example: Set the interval of sending cluster register packet to 80 seconds.
Switch(Config)#cluster register timer 80

6.2.2.3 cluster ip-pool

Command: cluster ip-pool <*commander-ip*>
no cluster ip-pool
Function: Configure private IP address pool for member switches of the cluster.
Parameter: <*commander-ip*> is the IP address of the commander switch in dotted decimal format. The value of the last byte in IP address is lower than (255-24).
Default: There is no private IP address pool by default.
Command mode: Global Mode.
Usage Guide: Before creating the cluster, users have to set the private IP address pool in the commander switch. The cluster can't be created if the private IP address pool is not set. When candidate switches join the cluster, the commander switch assigns a private IP address for each member switch. These IP addresses are used to communicate between the commander switch and the member switches. This command can be only used in a non-member switch. As soon as the cluster is created, the users can't modify the IP address pool. The 'no cluster ip-pool' command clears the address pool and there is no default setting to be restored.
Example: Set the private IP address pool for the member switches to 192.168.1.64
Switch(config)#cluster ip-pool 192.168.1.64

6.2.2.4 cluster commader

Command: cluster commander <*cluster-name*> [vlan <*vlan-id*>]
no cluster commander
Function: Enable a commander switch, create a cluster, or modify a cluster's name; the '**no cluster commander**' command deletes the cluster.
Parameter: <*cluster-name*> is the cluster's name; ***<vlan-id>*** is the VLAN of the Layer 3 device which the cluster belongs to. If it is omitted, the cluster belongs to VLAN1.

Default: There is no cluster by default.
Command mode: Global Mode
Usage Guide: This command sets the switch as a commander switch and creates a cluster. Before executing this command, users must configure a private IP address pool. If users executes this command again, the cluster's name will be changed and this information is distributed to the member switches. If users execute this command in a member switch, an error will be displayed. If users execute this command again with a new vlan id, the new vlan id is invalid.
Example: Set the switch as a commander switch. The cluster's name is Switch and the vlan-id is vlan1
Switch(config)#cluster commander Switch vlan 1

6.2.2.5 cluster member

Command: cluster member {candidate-sn <*cand-sn*> | mac-address <*mac-add*>
[<*mem-id*>]} [password <*pass*>]
no cluster member <*mem-id* >
Function: Add a candidate switch to the cluster in the commander switch; the '**no cluster member <*mem-id* >**'command deletes a member switch from the cluster.
Parameter: <*mem-id*> is the member ID, valid range is 1 to 23; **<*cand-sn*>** is the sequence number of the switch in the candidate switch list, valid range is 0 to 127. Users can use ';' or '-' to specify multiple numbers or successive numbers; **<*mac-add*>** is the MAC address of the member switch in the format of XX-XX-XX-XX-XX-XX; **<*pass*>** is the privileged password of the member switch.
Default: None
Command mode: Global Mode
Usage Guide: When this command is executed in the commander switch, the switch with **<*mac-add*>** or **<*cand-sn*>** will be added to the cluster which the commander switch belongs to. If this command is executed in a non-commander switch, an error will be displayed.
Example: In the commander switch, add the candidate switch which has the sequence number as 17 and password as mypassword to the cluster.
Switch(config)#cluster member candidate-sn 17 mypassword

6.2.2.6 cluser auto-add enable

Command: cluster auto-add enable
no cluster auto-add enable
Function: When this command is executed in the commander switch, the newly discovered candidate switches will be added to the cluster as a member switch automatically; the '**no cluster auto-add enable**' command disables this function.
Parameter: None
Default: This function is disabled by default. That means that the candidate switches are not automatically added to the cluster.

Command mode: Global Mode

Usage Guide: When this command is executed in the commander switch and the commander switch receives the cluster register packets sent by the new switch, the commander switch adds the candidate switch to the cluster. If this command is executed in a non-commander switch, an error will be displayed.

Example: Enable the auto adding function in the commander switch.

Switch(config)#cluster auto-add enable

6.2.2.7 rcommand member

Command: rcommand member *<mem-id>*

Function: In the commander switch, this command is used to remotely manage the member switches in the cluster.

Parameter: *<mem-id>* is the cluster ID of the member switch, valid rang is 1 to 23.

Default: None.

Command mode: Admin Mode.

Usage Guide: Enter the Admin Mode of the member switch and configure the member switch remotely. Use '**exit**' to quit the configuration interface of the member switch. If this command is executed in a non-commander switch, an error will be displayed.

Example: In the commander switch, enter the configuration interface of the member switch with mem-id 15.

Switch#rcommand member 15

6.2.2.8 rcommand commander

Command: rcommand commander

Function: In the member switch, use this command to manager and configure the commander switch remotely.

Parameter: None

Default: None.

Command mode: Admin Mode.

Usage Guide: This command is used to configure the commander switch remotely. Users have to telnet the commander switch by passing the authentication. The command '**exit**' is used to quit the configuration interface of the commander switch. If this command is executed in the commander switch, an error will be displayed.

Example: In the member switch, enter the configuration interface of the commander switch.

Switch#rcommand commander

6.2.2.9 cluster reset member

Command: cluster reset member *<mem-id>*

Function: In the commander switch, this command can be used to reset the member switch.

Parameter: *<mem-id>* is the cluster ID of the member switch, valid rang is 1 to 23. Users can use '-' or ';' to input many ***<mem-id>.***
Default: None.
Command mode: Admin Mode.
Instructions: In the commander switch, users can use this command to reset a member switch. If this command is executed in a non-commander switch, an error will be displayed.
Example: In the commander switch, reset the member switch 16.
Switch#cluster reset member 16

6.2.2.10 cluster update member

Command: cluster update member *<mem-id>* *<src-url>* *<dst-url>* [ascii | binary]
Function: In the commander switch, this command is used to remotely upgrade the member switch.
Parameter: *<mem-id>* is the cluster ID of the member switch, valid rang is 1 to 23; ***<src-url>*** is the source path of the file which need to be copied; ***<dst-url>*** is the destination path of the file which need to be copied; **ascii** means that the file is transmitted in ASCII format; **binary** means that the file is transmitted in binary format. When ***<src-url>*** is a FTP address, its format is like: ftp: //*<username>*: *<password>*@*<ipaddress>*/*<filename>*. *<username>* is the FTP user name, *<password>* is the FTP password, *<ipaddress>* is the IP address of the FTP server and *<filename>* is the file name. When ***<src-url>*** is a TFTP address, its format is like: tftp: //*<ipaddress>*/*<filename>*. *<ipaddress>* is the IP address of the TFTP server and *<filename>* is the file name.

The special keywords of filename:

Keyword	Source address or destination address
startup-config	Startup configuration file
nos.img	System file

Default: None.
Command mode: Admin mode.
Usage Guide: The commander switch sends the remote upgrade command to the member switch. The member switch is upgraded and reset. If this command is executed in a non-commander switch, an error will be displayed.
Example: In the commander switch sends the remote upgrade command to the member switch which has mem-id as 10, src-url as ftp: //SWITCH: SWITCH@192.168.1.1/nos.img and dst-url as nos.img.
Switch#cluster update member 10 ftp://Switch:Switch@192.168.1.1/nos.img nos.img

6.2.2.11 cluster holdtime

Command: cluster holdtime *<second>*
no cluster holdtime

Function: In the commander switch, set holdtime of heartbeat of the cluster; the '**no cluster holdtime**' command restores the default setting.
Parameter: <*second*> is the holdtime of heartbeat of the cluster, valid range is 20 to 65535. The holdtime of heartbeat means the maximum valid time of heartbeat packets. When the heartbeat packets are received again, the holdtime is reset. If no heartbeat packets are received in the holdtime, the cluster is invalid.
Default: The holdtime of heartbeat is 80 seconds by default.
Command mode: Global Mode.
Instructions: In the commander switch, this command is used to set the holdtime of heartbeat. And this information is distributed to all the member switches. If this command is executed in a non-commander switch and the value is less than the current holdtime, the setting is invalid and an error is displayed.
Example: Set holdtime of heartbeat of the cluster to 100 seconds
Switch(config)#cluster holdtime 100

6.2.2.12 cluster heartbeat

Command: cluster heartbeat <*interval*>
no cluster heartbeat
Function: In the commander switch, set interval of sending heartbeat packets among the switches of the cluster; the '**no cluster heartbeat**' command restores the default setting.
Parameter: <*interval*> is the interval of heartbeat of the cluster, valid range is 1 to 65535.
Default: The interval of heartbeat is 8 seconds by default.
Command mode: Global Mode.
Usage Guide: In the commander switch, this command is used to set the interval of heartbeat. And this information is distributed to all the member switches. If this command is executed in a non-commander switch and the value is more than the current holdtime, the setting is invalid and an error is displayed.
Example: Set the interval of sending heartbeat packets of the cluster to 10 seconds.
Switch(config)#cluster heartbeat 10

6.2.2.13 clear cluster candidate-table

Command: clear cluster candidate-table
Function: Clear the list of candidate switches discovered by the commander switch.
Parameter: None.
Default: None.
Command mode: Admin Mode.
Instructions: In the commander switch, this command is used to clear the list of candidate switches discovered by the commander switch. If this command is executed in a non-commander switch, an error will be displayed.
Example: Clear the list of candidate switches discovered by the commander switch
Switch#clear cluster candidate-table

6.3 Cluster configuration Example

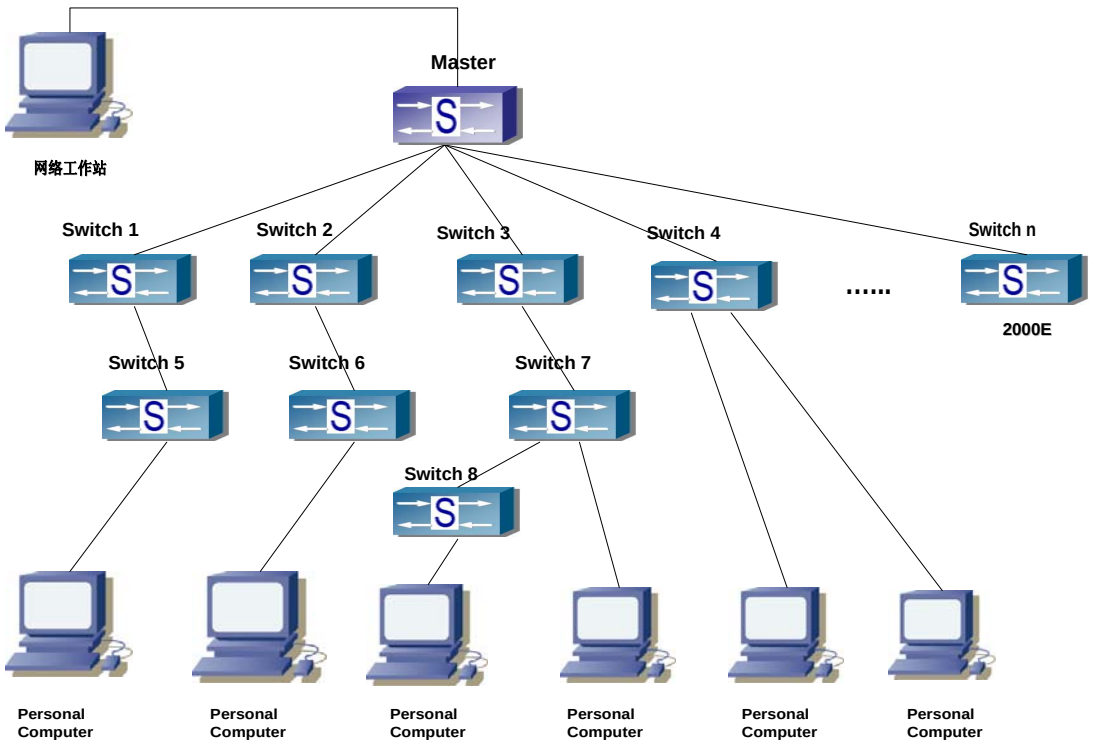


Fig 6.1 Example of Cluster configuration:

As above,Numbers of switches connect witch 7 host computers, amongst one Switch is the command switch and connect with the network station.

Configuration Procedure：

switch1（Others the same）

Switch1(config)#cluster run

Switch1(config)#cluster register timer 90

commander switch

Switch(config)#cluster run

Swich(config)#cluster commander-ip 192.168.1.64

Switch(config)#cluster commander master vlan 16

Switch(config)#cluster auto-add enable

Switch(config)#cluster member mac-address 00-03-0f-23-16-28 id 16 password 1234567

Switch(config)exit

Switch#rcommand member 16

Switch1#config

Switch1(config)#vlan 3

6.4 Cluster Administration Troubleshooting

6.4.1 Monitor and Debug Command List

6.4.1.1 show cluster

Command: show cluster
Function: Display the basic information of the member or command switch
Parameter: None
Default: None.
Command mode: Admin Mode
Usage Guide: The system will process this command separately for command switch, member switch and candidate switch.
Example:
1. Show cluster information on the command switch.
Switch#show cluster
Command switch for cluster CLUSTER
Total number of members: 4
Status: 0 Inactive
Time since last status change: 2 hours, 34 minutes, 25 seconds
Heartbeat interval: 10 seconds
Heartbeat hold-time: 100 seconds
2. Show cluster information on the member switch.
Switch#show cluster
Member switch for cluster CLUSTER
Member Number: 3
Management IP address: 192.168.1.64
Command switch mac address: 00-03-0f-00-28-e6
Heartbeat interval: 10 seconds
Heartbeat hold-time: 100 seconds
Status: Active
3. Show cluster information on the candidate switch.
Switch#show cluster
Candidate switch
Register timer: 60 seconds

Description:

For the command switch	Description
Command switch for cluster <*clustername*>	Cluster name and role, <clustername> is the name of the cluster.
Total number of members	Number of members in the cluster.
Status	Status of the cluster's members, and

	number of members that are down.
Time since last status change	Time since last status change.
Heartbeat interval	Interval for heartbeat.
Heartbeat hold-time	Hold-time for heartbeat.
For the member switch	**Description**
Member switch for cluster <*clustername*>	Cluster name and role, <clustername> is the name of the cluster
Member number	ID for the member cluster.
Management IP address	Public IP address for the command switch.
Command switch mac address	MAC address for the command switch.
Heartbeat interval	Interval for heartbeat.
Heartbeat hold-time	Hold-time for heartbeat.
For the candidate switch	**Description**
Candidate switch：	
Register timer	Interval for the register timer.

6.4.1.2 show cluster candidates

Command: show cluster candidates

Function: Display the statistic information of the candidates on the switch

Parameters: None.

Default: None.

Command mode: Admin Mode.

Usage Guide: Executing this command on the switch will display the information of the candidate switches. If this command is not executed on the command switch, error will be returned.

Example: Show the candidate switches for the cluster on the command switch.

```
Switch#show cluster candidates
SN     MAC Address          Ip Address       Name                Device Type
---- ----------------- --------------- ------------------- ----------------
0      00-03-0f-00-28-e8    192.168.1.54      slave1            DCS-2008E
1      00-03-0f-01-33-21    192.168.1.23      slave2            DCS-2017E
2      00-03-0f-20-14-09    192.168.2.5       slave3            DCS-2017E
3      00-03-0f-00-58-67    192.168.3.3       slave4            DCS-2026E
```

Show information：

show cluster candidates	**Description displayed as lists**
SN	Serial number.
MAC Address	MAC address for the candidate switch.
IP Address	IP address for the candidate switch.
Name	Host name for the candidate switch.
Device Type	Device type for the candidate switch.

6.4.1.3 show cluster members

Command: show cluster members

Function: Display the statistic information of the joined members on the switch.

Parameters: None.

Default: None.

Command mode: Admin Mode.

Usage Guide: Executing this command on the switch will display the information of the joined member switches If this command is not executed on the command switch, error will be returned.

Example: Show information for cluster members on the command switch.

```
Switch#show cluster members
SN     MAC Address          Name                Device Type          Status
---- ----------------- ------------------- ------------------- ----
0      00-03-0f-00-28-e6    master              DCS-2026E            UP
1      00-03-0f-00-28-e8    slave1              DCS-2008E            UP
2      00-03-0f-01-d2-69    slave2              DCS-2017E            DOWN
3      00-03-0f-25-13-f2    slave3              DCS-2026E            UP
4      00-03-0f-09-a5-c7    slave4              DCS-2008E            DOWN
```

Description

show cluster members	**Discription as lists**
SN	Serial number for the member.
MAC Address	MAC address for the candidate switch
Name	Host name for the member switch.
Device Type	Device type for the member switch.
Status	Status for the member switch :up or down.

6.4.1.4 debug cluster application

Command: debug cluster application

no debug cluster application

Function：Display debugging message on data transmission between the switches when the command or member switch joins a cluster. If no is put in front of the command, this command will be disabled.

Parameters: None.

Default: None.

Command mode: Admin Mode.

Usage Guide: Debugging can be enabled for the switch application if this command is executed. If this command is enabled, brief debugging information for the configuration package and SNMP/WEB/RCOMMAND based on the cluster will be displayed if this command is enabled.

Example: Enable the debugging for the cluster application.

```
Switch#debug cluster application
```

6.4.1.5 debug cluster packets

Command: debug cluster packets {register|build|heartbeat} {in|out} [detail]
no debug cluster packets {register|build|heartbeat} {in|out} [detail]
Function: Enable the debugging message of cluster admin receiving and sending packets; the 'no' form of this command disables the enabled debugging messages.
Parameter: Register displays a register packet of cluster administration. **Build** displays join a cluster or delete packet from the cluster administration. **Heartbeat** packet for check if cluster admin members are working properly; **in** parameter displays the debugging messages related to the command or member switches receiving packets; **out** parameter displays the debugging messages related to the command or member switches sending packets.
Default: None.
Command mode：Admin Mode.
Usage Guide: Cluster packets debugging will be enabled if this command is executed, including the keep-alive packets, the registering packets, and construction packets.
Example: Enable debugging for cluster registering packets.
Switch#debug cluster packets register in

6.4.2 Cluster administration troubleshooting

Cluster heart beat count and cluster heart beat keep alive time can be set on the command switch. The cluster heart beat count should be no less than current cluster heartbeat keeps alive time, or the configuration will not be available and error will be reported.

When the private IP address pool is configured for the switch, it must be guaranteed that the address pool configuration must not conflict with any public IP addresses.

- VLAN 1 must be contained in the ALLOWED VLAN configuration if switches are connected through the TRUNCK ports. Or switches in the cluster may be unable to communicate with each other.
- It is recommended a higher tier switch of better performance should be used as the command switch because the load of the command switch is usually quite high.
- Routing protocols (rip, ospf, bgp) should not be enabled in VLAN 1, if cluster commander is enabled in VLAN 1 in the command switch. Or the routing would be looped because the cluster private management subnet would have been broadcasted to other switches.

Chapter 7 Port Configuration

7.1 Port Introduction

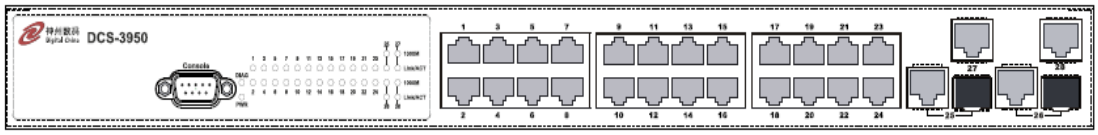


Fig 7-1 Ports on DCS-3950-28CT

The ports on DCS-3950 series are showed in the above picture (take DCS-3950-28CT as an example). DCS-3950-28CT provides 24＋2＋2 ports, 24 of which are 10/100Base-TX ethernet interfaces with fixed configuration, 2 of which are 1000Base-TX/1000Base-FX single/multi mode interfaces, the other 2 of which are 1000Base-TX stack interfaces.

On the panel of DCS-3950-28CT, each port is marked with a port ID. The relationship between these port IDs and the port IDs provided by the DCS-3950-28CT operating system (software port IDs)is listed as follows:

Physical port ID	Software port ID
24 10/100Base-T	ethernet 0/0/1-24
2 1000Base-TX/1000Base-FX	ethernet 0/0/25-26
2 1000Base-TX	ethernet 0/0/27-28

If users want to configure some ports, they can use the command **interface ethernet *<interface-list>*** to enter corresponding ethernet port configuration mode, the parameter ***<interface-list>*** can be 0/0/1-28. When ***<interface-list>*** contain more than one ports, please use special charactuer including';'and '-' to connect them. In the ethernet port configuration mode, the port rate, duplex mode and the traffic control can all be configured, in response, the performace of corresponding ports will change accordingly.

7.2 Port Configuration

7.2.1 Network Port Configuration

7.2.1.1 Network Port Configuration Task List

1. Enter the network port configuration mode
2. Configure the properties for the network ports

（1） Configure combo mode for combo ports
（2） Enable/Disable ports
（3） Configure port names
（4） Configure port cable types
（5） Configure port speed and duplex mode
（6） Configure bandwidth control
（7） Configure traffic control
（8） Enable/Disable port loopback function
（9） Configure Combo port mode

3. Set the packet suppression function

1. Enter the Ethernet port configuration mode

Command	Explanation
Interface Mode	
interface ethernet <*interface-list*>	Enters the network port configuration mode.

2. Configure the properties for the Ethernet ports

Command	Explanation
Interface Mode	
shutdown **no shutdown**	Enables/Disables specified ports
name <*string*> **no name**	Names or cancels the name of specified ports
mdi { auto | across | normal } **no mdi**	Sets the cable type for the specified port
speed-duplex {auto | force10-half | force10-full | force100-half | force100-full | force100-fx | {{force1g-half | force1g-full} [nonegotiate [master | slave]] } }	Sets port speed and duplex mode
bandwidth control <*bandwidth*> **[transmit]** **no bandwidth control**	Sets receive/send data bandwidth on specified ports
flow control **no flow control**	Enables/Disables traffic control function for specified ports
loopback **no loopback**	Enables/Disables loopback test function for specified ports

combo-forced-mode {copper-forced | copper-prefered-auto | sfp-forced | sfp-prefered-auto } **no combo-forced-mode**	Sets combo port mode

3. Set the packet suppression function

Command	Explanation
Port configuration mode	
packet-suppression <*packets*> {broadcast|brmc|brmcdlf|all} **no packet-suppression**	Enable the packet suppresntion function of the switch, and set the max data traffic allowed to pass. The 'no packet-suppression' command is used to cancel the packet suppression function.

7.2.1.2 Network Port Configuration Command List

7.2.1.2.1 Bandwidth

Command: bandwidth control <*bandwidth*> [transmit]
no bandwidth control
Function: This command enables the bandwidth control for the switch. If no is put in front of this command, bandwidth control will be disabled.
Parameters: <*bandwidth*> is the bandwidth to be limited in kbps limited to 62~1000000. transmit means to limit bandwidth for data transmission while for bandwidth control at the receiving side, please refer to the command packet suppression.
Command mode: Interface Mode
Default: Bandwidth is disabled by default.
Usage Guide: If bandwidth control is enabled, and restrained banwidth is configured, the maximum bandwidth for the interface will be limited to the value set by the command, but not the physical speed for the interface.
Example: Configure the transmitting rate to be 40M bps for interface 1 to 8.
Switch(Config)#interface ethernet 0/0/1-8
Switch(Config-Port-Range)#bandwidth control 40000

7.2.1.2.2 packet-suppression

Command: packet-suppression <*kbps*> {broadcast|brmc|brmcdlf|all}
no packet-suppression
Function: Set the traffic limit for broadcasts, multicasts and unknown destination unicasts on all ports in the switch; the '**no packet-suppression**' command disables this traffic throttle function on all ports in the switch,
Parameters: <*kbps*> is the number of bits that is allowed to be delivered, which is limited to 62~1000000. **broadcast** is for broadcasted flow. **brmc** is for broadcasted or

multicasted flow. **brmcdlf** is for boradcasted or multicasted or DLF flow. **all** is for all types of flow.
Command mode: Interface Mode
Default: Frame is delivered at line speed by default.
Usage Guide: With this command, bandwidth can be controlled for specific flow types. All ports in the switch belong to a same broadcast domain if no VLAN has been set. The switch will send the abovementioned three traffics to all ports in the broadcast domain, which may result in broadcast storm and so may greatly degrade the switch performance. Enabling Broadcast Storm Control can better protect the switch from broadcast storm. Note the difference of this command in 10Gb ports and other ports. If the allowed traffic is set to 3, this means allow 3,120 packets per second and discard the rest for 10 GB ports. However, the same setting for non-10Gb ports means to allow 3 broadcast packets per second and discard the rest.
Example: Llimit the number of broadcasting packet that can be received by the switch to be 1000kbit per second.
Switch(Config-Port-Range)#packet-suppression 1000 broadcast

7.2.1.2.3 speed-duplex

Command: speed-duplex {auto|force10-half|force10-full|force100-half|force100-full | force100-fx |{{force1g-half | force1g-full} [nonegotiate [master|slave]] }}
Function: Configure the speed and duplex mode of the port.
Parameters: auto is for auto negotiation. **force10-half** is for forced speed of 10Mbit/s, and half duplex mode. **force10-full** is for forced speed of 10Mbit/s and full duplex mode. **force100-half** is for forced speed of 100Mbit/s and half duplex mode. force100-full is for forced 100Mbit/s. force100-fx is for forced 100Mbit/s fiber mode. **force1g-half** is for forced 1000Mbit/s and half duplex mode. **force1g-full** is for forced 1000Mbit/s and full duplex mode.
Command mode: Interface Mode.
Default: Speed and duplex auto negotiation is enabled by default.
Usage Guide: When configuring the speed and duplex of a port, the speed and duplex must keep compatible with the remote connection pear. If the remote pear is configured as auto negotiation, the local pear should be configured the same. If the remote one is configured in forced mode, the local should be too.
Example: Connect the port 1 of Switch1 with the port 1 of Switch2, and configure them as forced 100Mbit/s and half duplex mode.
Switch1(Config)#interface ethernet 0/0/1
Switch1(Config-Ethernet1-0/0/1)#speed-duplex force100-half
Switch2(Config)#interface ethernet 0/0/1
Switch2(Config-Ethernet0/0/1)#speed-duplex force100-half

7.2.1.2.4 combo-forced-mode

Command: combo-forced-mode {copper-forced|copper-prefered-auto|sfp-forced|

sfp-prefered-auto }

no combo-forced-mode

Function: Set to combo port mode (combo ports only); the '**no combo-forced-mode**' command restores to default combo mode for combo ports, i.e., fiber ports first.

Parameters: copper-forced forces use of copper cable port; **copper-preferred-auto** for copper cable port first; **sfp-forced** forces use of fiber cable port; **sfp-preferred-auto** for fiber cable port first.

Command mode: Interface Mode

Default: The default setting for combo mode of combo ports is fiber cable port first.

Usage Guide: The combo mode of combo ports and the port connection condition determines the active port of the combo ports. A combo port consists of one fiber port and a copper cable port. It should be noted that the speed-duplex command applies to the copper cable port while the negotiation command applies to the fiber cable port, they should not conflict. For combo ports, only one, a fiber cable port or a copper cable port, can be active at a time, and only this port can send and receive data normally.

For the determination of the active port in a combo port, see the table below. The headline row in the table indicates the combo mode of the combo port, while the first column indicates the connection conditions of the combo port, in which 'connected' refers to a good connection of fiber cable port or copper cable port to the other devices.

	Copper forced	**Copper preferred**	**SFP forced**	**SFP preferred**
Fiber connected, copper not connected	Copper cable port	Fiber cable port	Fiber cable port	Fiber cable port
Copper connected, fiber not connected	Copper cable port	Copper cable port	Fiber cable port	Copper cable port
Both fiber and copper are connected	Copper cable port	Copper cable port	Fiber cable port	Fiber cable port
Neither fiber nor copper are connected	Copper cable port	Fiber cable port	Fiber cable port	Fiber cable port

Note:

- ☞ If a combo port connects to another combo port, it is recommended for both parties to use copper-forced or fiber-forced mode.
- ☞ This command can not use below speed-duplex force100-fx
- ☞ Run 'show interface' under Admin Mode to check for the active port of a combo port .The following result indicates if the active port for a combo port is the fiber cable port:

  ……

  Hardware is Gigabit-combo, active is fiber(or copper).

  ……

Example: Set ports 0/1/1,0/2/1 to fiber-forced
Switch(Config)#interface ethernet 0/1/1;0/2/1
Switch(Config-Port-Range)#combo-forced-mode sfp-forced

7.2.1.2.5 flow control

Command: flow control
no flow control
Function: Enable the flow control function for the port: the 'no flow control' command disables the flow control function for the port.
Command mode: Interface Mode
Default: Port flow control is disabled by default.
Usage Guide: After the flow control function is enabled, the port will notify the sending device to slow down the sending speed to prevent packet loss when traffic received exceeds the capacity of port cache. The switch's ports support IEEE802.3X flow control; the ports work in half-duplex mode, supporting back-pressure flow control.
Note: When enable the port flow control function, speed and duplex mode of both ends should be the same.
Example: Enable the flow control function in ports 1/1-8.
Switch(Config)#interface ethernet 0/0/1-8
Switch(Config-Port-Range)#flow control

7.2.1.2.6 interface ethernet

Command: interface ethernet <*interface-list*>
Function: Enter Ethernet Interface Mode from Global Mode.

Parameters: <*interface-list*> stands for port number. Formats and ranges for the port numbers are described in the ports introduction section of this chapter.
Command mode: Global Mode
Usage Guide: Run the *exit* command to exit the Ethernet Interface Mode to Global Mode.
Example: Enter the Ethernet Interface Mode for ports 0/0/1, 0/0/4-5, 0/0/8.
Switch(Config)#interface ethernet 0/0/1;0/0/4-5;0/0/8
Switch(Config-Port-Range)#

7.2.1.2.7 loopback

Command: loopback
no loopback
Function: Enable the loopback test function in an Ethernet port; the '**no loopback**' command disables the loopback test on an Ethernet port.
Default: Loopback test is disabled in Ethernet port by default.
Command mode: Interface Mode
Usage Guide: Loopback test can be used to verify the Ethernet ports are working

normally.
Example: Enable loopback test in Ethernet ports 0/0/1 -8.
Switch(Config)#interface ethernet 0/0/1-8
Switch(Config-Port-Range)#loopback

7.2.1.2.8 mdi

Command: mdi {auto|across|normal}
no mdi
Function: Set the cable types supported by the Ethernet port; the '**no mdi**' command sets the cable type to auto-identification.
Parameters: auto indicates auto identification of cable types; **across** indicates crossover cable support only; **normal** indicates straight-through cable support only.
Command mode: Interface Mode .
Default: Port cable type is set to auto-identification by default.
Usage Guide: This command is only available for the fixed ports. Fixed ports of the switch are auto-negotiation and auto-cross ethernet ports. DCS-3950 is able to make connections automatically according to the cable types and connection types.
Example: Set the cable type support of Ethernet ports 0/0/1-8 to crossover cable only.
Switch(Config)#interface ethernet 0/0/1-8
Switch(Config-Port-Range)#mdi across

7.2.1.2.9 name

Command: name <*string*>
no name
Function：Set name for specified port; the '**no name**' command cancels this configuration.
Parameter：***<string>*** is a character string, which should not exceeds 200 characters.
Command mode: Interface Mode .
Default：No port name by default.
Usage Guide：This command is for helping the use manage switches, such as the user assign names according to the port application, e.g. financial as the name of 1-8 ports which is used by financial department, engineering as the name of 9-20 ports which belongs to the engineering department, while the name of 21-24 ports is assigned with Server, which is because they connected to the server. In this way the port distribution state will be brought to the table.
Example：Specify the name of 0/0/1-8 port as financial
Switch(Config)#interface ethernet 0/0/1-8
Switch(Config-Port-Range)#name financial

7.2.1.2.10 shutdown

Command: shutdown
no shutdown

Function: Shut down the specified Ethernet port; the '**no shutdown**' command opens the port.
Command mode: Interface Mode .
Default: Ethernet port is open by default.
Usage Guide: When Ethernet port is shut down, no data frames are sent in the port, and the port status displayed when the user types the '**show interface**' command is 'down'.
Example: Open ports 0/0/1-8.
Switch(Config)#interface ethernet 0/0/1-8
Switch(Config-Port-Range)#no shutdown

7.2.1.2.11virtual-cable-test

Command: virtual-cable-test
Function: Test the physical connection of ethernet cable. Much information can be displayed by this command, including well for working well, short for short circuit, open for open circuit, mismatch for mismatch of impedance, and fail for testing failure. If any information is abnormal, then locations of the failure will be reported.
Command mode: Port Mode.
Default: Physical connection testing is disabled by default.
Usage Guide: For twisted-pair connections, RJ-45 connectors must be complied with IEEE 802.3 standards, or the line pair displayed will not be constant with the physical ones. For fast ethernet ports, only pairs of (1, 2) and (3, 6) will be used. The result will effect for only these two pairs. If gigabit ethernet is connected to a fast ethernet port, (4, 5) and (7, 8) will not be effect for the result. The result will vary according to the type of the twisted-pair lines, the environment temperature, and the working voltage. If the environment temperature is 20 Celsius degress, and the voltaqe keeps contan, the twisted-pair is limited to 100m. And +/-2 of error is allowed. To be mentioned, when the interface is to be tested, all the data connections over the specified interface will be interrupted. And it will recover to initialized after 5~10 seconds.
Standard EIA/TIA 568A: (1Green/White,2Green). (3Orange/White,6Orange), (4Blue,5Blue/Write), (7Brown/Write,Brown).
Standard EIA/TIA 568B: (1Orange/White,2Orange), (3Green/White,6Green). (4Blue,5Blue/Write), (7Brown/Write,Brown).
Example: Test the twisted-pair connection of gigabit ethernet port 0/0/25.
Switch(Config)#interface ethernet 0/0/25
Switch(Config-Ethernet0/0/25)#virtual-cable-test
Interface Ethernet0/0/25:

Cable pairs	Cable status	Error lenth (meters)
(1, 2)	open	5
(3, 6)	open	5
(4, 5)	open	5
(7, 8)	short	5

7.2.2 VLAN Interface Configuration

7.2.2.1 VLAN Interface Configuration Task List

1. Enter VLAN Mode
2. Configure the IP address for VLAN interface and enable VLAN interface.

1. Enter VLAN Mode

Command	Explanation
Global Mode	
interface vlan <*vlan-id*> **no interface vlan <*vlan-id*>**	Enters VLAN Interface Mode; the '**no interface vlan <*vlan-id*>**' command deletes specified VLAN interface.

2. Configure the IP address for VLAN interface and enables VLAN interface.

Command	Explanation
VLAN Mode	
ip address <*ip-address*> <*mask*> [secondary] **no ip address [<*ip-address*> <*mask*>]**	Configures the VLAN interface IP address; the '**no ip address [<*ip-address*> <*mask*>]'** command deletes the VLAN interface IP address.
VLAN Mode	
Shutdown **no shutdown**	Enables/Disables VLAN interface

7.2.2.2 Vlan Interface Command List

7.2.2.2.1 interface vlan

Command: interface vlan <*vlan-id*>
no interface vlan <*vlan-id*>
Function: Enter VLAN Interface Mode; the '**no interface vlan <*vlan-id*>**' command deletes existing VLAN interface.
Parameters: <*vlan-id*> is the VLAN ID for the establish VLAN, the valid range is 1 to 4094.
Command mode: Global Mode.
Usage Guide: None
Example: Enter into the VLAN Interface Mode for VLAN1.
Switch(Config)#interface vlan 1
Switch(Config-If-Vlan1)#

7.2.2.2.2 ip address

Command: ip address <*ip-address*> <*mask*> [secondary]
no ip address [<*ip-address*> <*mask*>] [secondary]
Function: Set the IP address and mask for the switch; the '**no ip address [<*ip-address*> <*mask*>][secondary]'** command deletes the specified IP address setting.
Parameters: <*ip-address*> is the IP address in decimal format; **<*mask*>** is the subnet mask in decimal format; **[secondary]** indicates the IP configured is a secondary IP address.
Command mode: VLAN Interface Mode
Default: No IP address is configured by default.
Usage Guide: This command configures the IP address for VLAN interface manually. If the optional parameter secondary is not present, the IP address will be the primary IP of the VLAN interface, otherwise, the IP address configured will be the secondary IP address for the VLAN interface. A VLAN interface can have one primary IP address but multiple secondary IP addresses. Both primary IP address and secondary IP addresses can be used for SNMP/Web/Telnet management. In addition, DCS-3950 allows IP addresses to be obtained through BootP/DHCP.
Example: Set the IP address as 192.168.1.10/24.

Switch(Config-If-Vlan1)#ip address 192.168.1.10 255.255.255.0

7.2.2.2.3 shutdown

Command: shutdown
no shutdown
Function: Shut down the specified VLAN Interface; the '**no shutdown**' command opens the VLAN interface.
Command mode: VLAN Interface Mode .
Default: VLAN Interface is enabled by default.
Usage Guide: When VLAN interface is shutdown, no data frames will be sent by the VLAN interface. If the VLAN interface needs to obtain IP address via BootP/DHCP protocol, it must be enabled.
Example: Enable VLAN1 interface of the switch. Switch (Config-If-Vlan1)#no shutdown

7.2.3 Port Mirroring Configuration

7.2.3.1 Introduction to Port Mirroring

Port mirroring refers to the duplication of data frames sent/received on a port to another port. The duplicated port is referred to as mirror source port and the duplicating port is referred to as mirror destination port. A protocol analyzer (such as Sniffer) or

RMON monitoring instrument is often attached to the mirror destination port to monitor and manage the network and diagnostic.

DCS-3950 series switch support one mirror destination port only. The number of mirror source ports are not limited, one or more may be used. Multiple source ports can be within the same VLAN or across several VLANs. The destination port and source port(s) can be located in different VLANs.

7.2.3.2 Port Mirroring Configuration Task List

1. Specify mirror source port
2. Specify mirror destination port

1. Specify mirror source port

Command	**Explanation**
Port mode	
monitor session <*session*> source interface <*interface-list*> {rx| tx| both} **no monitor session <*session*> source interface <*interface-list*>**	Specify mirror source port, the **no monitor session <*session*> source interface <*interface-list*>** command deletes mirror source port

2. Specify mirror destination port

Command	**Explanation**
Port mode	
monitor session <*session*> destination interface <*interface-number*> **no monitor session <*session*> destination interface <*interface-number*>**	Specify mirror destination port;the **no monitor session <*session*> destination interface <*interface-number*>** command deletes mirror destination port

7.2.3.3 Mirror Port Command List

7.2.3.3.1 monitor session source interface

Command：monitor session <*session*> source interface <*interface-list*> {rx| tx| both}
no monitor session <*session*> source interface <*interface-list*>

Function：Specify port of mirror source; the '**no port monitor interface <*interface-list*>**' command deletes the mirror source port.

Parameter：**<*session*>** session is the session number for the mirror source. **<*interface-list*>** is the mirror source port list, in which special characters such as '-'、';' are available; **rx** is the flow received from the source port; **tx** is the flow sent from the

source port ;**both** refers to the flow both into and out from the mirror source
Command mode: Global Mode

Usage Guide： This command is for configuring the source port of the mirror. There is no limitation on the DCS-3950 to the mirror source port, which can be one port or many ports, and not only can the bilateral flow be sent out from or received into the mirror source port, but also the sent and received flows are available on single mirror source port. While mirroring several ports, their direction can vary but have to be configured by several times. The speed rate of the mirror source port and the destination port should be the same or else the packet may be lost. If the keyword **[rx | tx | both]** is not specified, then **both** is chosen by the system by default.
Notice: Session number of source and destination port in pairs should be the same.
Example: Configure the sent flow of the 1/1-4 mirror source port and the receiving flow of the 1/5 mirror port

Switch(Config)#monitor session 1 source interface ethernet 0/0/1-4 tx

7.2.3.3.2 monitor session destination interface

Command: monitor session <*session*> destination interface <*interface-number*>
no monitor session <*session*> destination interface <*interface-number*>
Function: None
Parameters: <*session*> is the session number for the mirror destination, which is limited between 1 and 100. However, according to the number of stacking, only one session can be supported in local mode. It can not be determined whether the session is in global mode or in local mode. For both mode, there will be a unique session number for each session. ***<interface-number>*** is the port number for the mirror destination.
Command mode: Global Mode.
Usage Guide: DCS-3950 only supports one destination mirror port by the time the document is written. To be mentioned, the destination mirror port should not be the member of port aggregations. And it is recommended that the throughput of a port should be no less than the sum total of throughput of individual ports.
Notice: Session numbers for source and destination ports should be the same.
Example: Configure the destination of mirror ports to be 0/0/7.
Switch(Config)#monitor session 1 destination interface ethernet 0/0/7

7.2.3.4 Port Mirroring Example

Please refer to the Port Configuration Example section.

7.2.3.5 Port Mirroring Troubleshooting.

7.2.3.5.1 show monitor

Command：show monitor
Function：Display the source and destination port information of the image.
Command mode：Admin Mode
Usage Guide: Information about source and destination port can be displayed by this command.
Example:
Switch#show monitor
session number : 1
Source ports: Ethernet0/0/8 Ethernet0/0/9
RX: No
TX: No
Both: Yes
Destination port: Ethernet0/0/24

Display information	Explanation
session number	Session number of the image
Source ports	Source ports of the image
RX	The image in the receiving direction of the port.
TX	The image in the transmitting direction of the port.
Both	The images in both the receiving and transmitting directions of the port.
Destination port	Destination port of the image

7.2.3.5.2 debug mirror

Command：debug mirror
no debug mirror
Function：Enable the debug information of the mirror, the ‘no debug mirror’ command is used to disable the debug information of the mirror.
Command mode：Admin Mode

7.2.3.5.3 Device Mirroring Troubleshooting

If problems occur on configuring port mirroring, please check the following first for causes:

- ☞ Whether the mirror destination port is a member of a trunk group or not, if yes, modify the trunk group.
- ☞ If the throughput of mirror destination port is smaller than the total throughput of mirror source port(s), the destination port will not be able to duplicate all source port traffic; please decrease the number of source ports, duplicate traffic for one direction

only or choose a port with greater throughput as the destination port.

7.3 Port Configuration Example

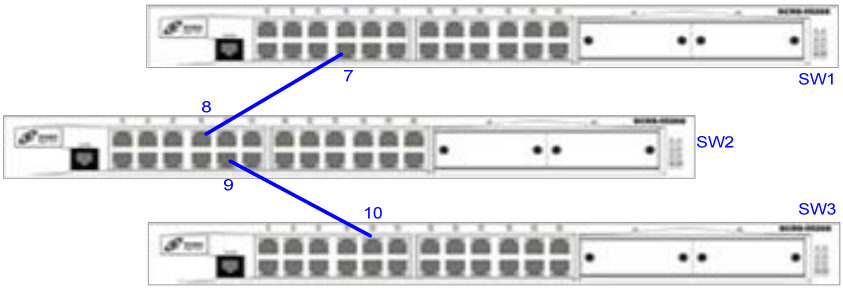


Fig 7-2 Port Configuration Example

Use default VLAN1 since VLAN is not configured on all of the switches.

Switch	Port	Attributes
SW1	0/0/7	10M/full
SW2	0/0/8-9	10M/full,mirror source port
	0/0/24	100M/full,mirror destinationport
SW3	0/0/10	10M/full

The configurations are listed below：

SW1：

Switch1(Config)#interface ethernet 0/0/7

Switch1(Config-Ethernet0/0/7)#speed-duplex force10-full

SW2：

Switch2(Config)#interface ethernet 0/0/8-9

l

Switch2(Config-Port-Range)#speed-duplex force10-full

Switch2(Config-Port-Range)#exit

Switch2(Config)#interface ethernet 0/0/24

Switch2(Config-Ethernet0/0/24)#speed-duplex force100-full

Switch2(Config-Ethernet0/0/24)#exit

Switch2(Config)#monitor session 1 source interface ethernet 0/0/8-9

Switch2(Config)#monitor session 1 destination interface ethernet 0/0/24

SW3：

Switch3(Config)#interface ethernet 0/0/10

Switch3(Config-Ethernet0/0/10)#speed-duplex force10-full

7.4 Port Troubleshooting

7.4.1 Monitor and Debug Command List

7.4.1.1 clear counters ethernet

Command: clear counters [ethernet <*interface-list*>]
Function：Clear counters information on Ethernet interface
Parameters：<*interface-list*>is the port ID of Ethernet
Command mode：Admin Mode
Default: Do not delete the counters information on Ethernet interface
Usage Guide: If interface name is not specified, all the interface statistics will be cleared.
Example: Clear the statistics of ethernet interface 0/0/1.
Switch#clear counters ethernet 0/0/1

7.4.1.2 show interface ethernet

Command：**show interface ethernet <*interface-list*>**
Function：Display the information of the ports on the specified switch.
Parameters：**<*interface-list*>**is the port ID, the format and value range of the port ID is explained in the port introduction part of this chapter.
Command mode：Admin Mode
Usage Guide: This command shows the speed and duplex of the specified interface, the flow control status, and the statistics for prevention of broadcasting storm and packets information that is being transferred.
Example: Display information about interface 0/0/1.
Switch#show interface ethernet 0/0/1

7.4.1.3 show interface ethernet status

Command：**show interface ethernet status**
Function：Show important status information for all Ethernet ports.
Parameters：None.
Command mode：Admin Mode
Usage Guide：The information showed at this command including: port number, Link and Protocol status, speed, Duplex, Vlan, port type, port name. The first line showed is the meaning for each abbreviations, following lines each line for one port status, and showed by port sequence.
Example：Show important status information for ports:
Switch#show interface ethernet status
Codes: A-Down - administratively down, a - auto, f - force, G - Gigabit

Interface	Link/Protocol	Speed	Duplex	Vlan	Type	Alias Name
0/0/1	UP/UP	f-100M	f-full	1	G-TX	
0/0/2	UP/UP	a-100M	a-full	trunk	G-TX	
0/0/3	UP/DOWN	auto	auto	1	G-TX	
0/0/4	A-Down/DOWN	auto	auto	1	G-TX	

information showed	meaning
Interface	Detail port number, no Ethernet prefix.
Link/Protocol	Port and protocol connect status, UP or DOWN, with '/' in middle. A-DOWN in link means administratively down.
Speed	Port speed, the format is mode-rate. Mode a means auto mode. At auto mode, the rate following is auto negotiation rate. If port protocol is DOWN, then here is auto only. Mode F means force mode, the rate following is forced set rate.
Duplex	Duplex status, show format is mode-duplex status. Mode A means auto mode, f means force mode. Duplex status is full or half.
Vlan	When port is access port, this means the Vlan, and when port is trunk port, this shows trunk.
Type	Hardware type. At present the hardware types are SFP, G-USB, G-TX, G-Combo, GBIC, XGE GBIC, FE. The bottom of table will show G is Gigabit. When port type is Combo, and port up without loop, it will show the active port is copper or fiber after the hardware type.
Alias Name	Port name set by user. If not set, it will show blank. If more than 15 byte, then show only first 15 byte.

7.4.1.4 show interface ethernet counter packet

Command：show interface ethernet counter packet

Function：Show all Ethernet port packet counter information.

Parameters：None.

Command mode：Admin Mode

Usage Guide：This command show input and output L2 uni-cast, multicast, broadcast and error packet counter. For each port there will be two lines, the first line for input packet, and second line for output.

Example：Show packet counter information:

Switch#show interface ethernet counter packet

Interface		Unicast(pkts)	BroadCast(pkts)	MultiCast(pkts)	Err(pkts)
0/0/1	IN	12,345,678	12,345,678,9	12,345,678,9	4,567
	OUT	23,456,789	34,567,890	5,678	0
0/0/2	IN	0	0	0	0
	OUT	0	0	0	0
0/0/3	IN	0	0	0	0
	OUT	0	0	0	0

0/0/4	IN	0	0	0	0
	OUT	0	0	0	0

information showed	meaning
Interface	detail port number, no Ethernet prefix.
IN / OUT	direction
Unicast	Quantity of uicast
BroadCast	Quantity of broadcast
MultiCast	Quantity of multicast
Err	Err

7.4.1.5 show interface ethernet counter rate

Command：show interface ethernet counter rate

Function：Show all Ethernet port rate counter information, for 5 minutes and 5 seconds input and output packet and byte quantity

Parameters：None.

Command mode：Admin Mode

Usage Guide：For each port it will have two lines, first line for 5 minutes, and second line for 5 seconds.

Example：Print Ethernet ports rate counter information

Switch#show interface ethernet counter rate

Interface		IN(pkts/s)	IN(bytes/s)	OUT(pkts/s)	OUT(bytes/s)
0/0/1	5m	13,473	12,345,678	12,345	1,234,567
	5s	135	65,800	245	92,600
0/0/2	5m	0	0	0	0
	5s	0	0	0	0
0/0/3	5m	0	0	0	0
	5s	0	0	0	0
0/0/4	5m	0	0	0	0
	5s	0	0	0	0

information showed	meaning
Interface	Detailed port number, no Ethernet prefix.
5m / 5s	time
IN(pkts/s)	Quantity of IN packets (pkts/s)
IN(bytes/s)	Quantity of IN bytes (pkts/s)
OUT(pkts/s)	Quantity of IN packets (pkts/s)
OUT(bytes/s)	Quantity of IN bytes (pkts/s)

7.4.1.6 show interface ethernet counter

Command：show interface ethernet counter

Function：Show all Ethernet port packet and rate counter information.

Parameters：None.

Command mode：Admin Mode

Usage Guide：first show packet counter information, and then rate counter information.

Example：Show Ethernet port counter information.

Switch#show interface ethernet counter

Chapter 8 MAC Table Configuration

8.1 Introduction to MAC Table

MAC table is a table identifies the mapping relationship between destination MAC addresses and switch ports. MAC addresses can be categorized as static MAC addresses and dynamic MAC addresses. Static MAC addresses are manually configured by the user, have the highest priority and are permanently effective (will not be overwritten by dynamic MAC addresses); dynamic MAC address is entries learnt by the switch in data frame forwarding, and is effective for a limited period. When the switch receives a data frame to be forwarded, it stores the source MAC address of the data frame and creates a mapping to the destination port. Then the MAC table is queried for the destination MAC address, if hit, the data frame is forwarded in the associated port, otherwise, the switch forwards the data frame to its broadcast domain. If a dynamic MAC address is not learnt from the data frames to be forwarded for a long time, the entry will be deleted from the switch MAC table.

There are two MAC table operations:

1. Obtain a MAC address;
2. Forward or filter data frame according to the MAC table.

8.1.1 Obtaining MAC Table

The MAC table can be built up statically and dynamically. Static configuration is to set up a mapping between the MAC addresses and the ports; dynamic learning is the process in which the switch learns the mapping between MAC addresses and ports, and updates the MAC table regularly. In this section, we will focus on the dynamic learning process of MAC table.

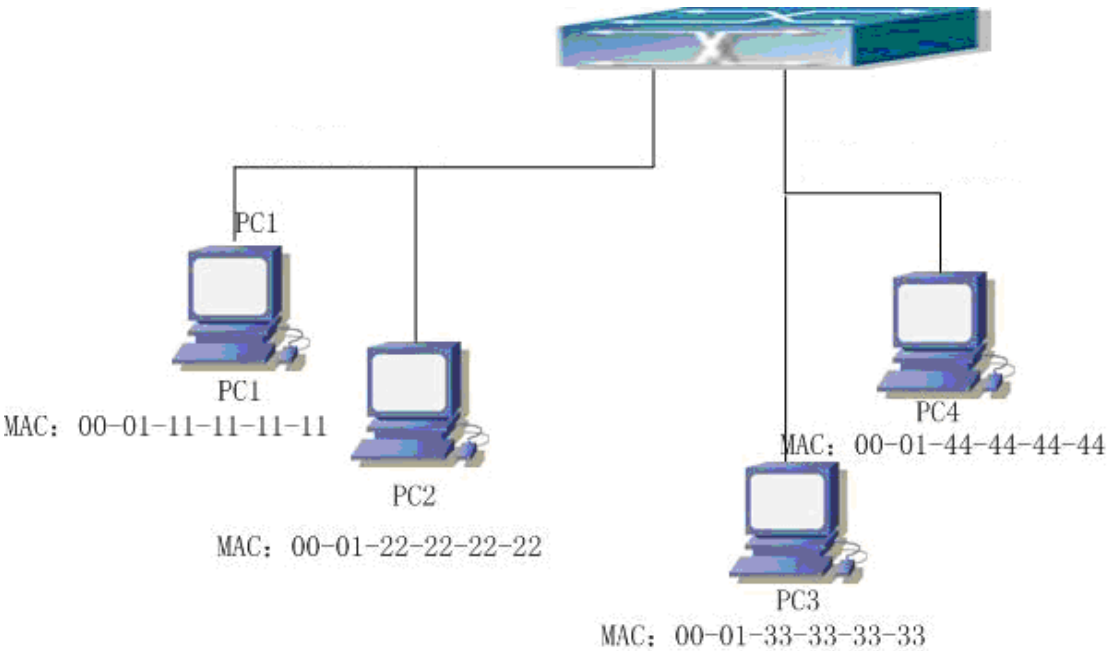


Fig 8.1 Dynamic Learning of MAC addresses.

The topology of the figure above: 4 PCs connected to DCS-3950 series switch, where PC1 and PC2 belongs to a same physical segment (same collision domain), the physical segment connects to port 5 of DCS-3950 series switch; PC3 and PC4 belongs to the same physical segment that connects to port 12 of DCS-3950 series switch.

The initial MAC table contains no address mapping entries. Take the communication of PC1 and PC3 as an example, the MAC address learning process is as follow:

1. When PC1 sends message to PC3, the switch receives the source MAC address 00-01-11-11-11-11 from this message, the mapping entry of 00-01-11-11-11-11 and port 5 is added to the switch MAC table.
2. At the same time, the switch learns the message is destined to 00-01-33-33-33-33, as the MAC table contains only a mapping entry of MAC address 00-01-11-11-11-11 and port 5, and no port mapping for 00-01-33-33-33-33 present, the switch broadcast this message to all the ports in the switch (assuming all ports belong to the default VLAN1).
3. PC3 and PC4 on port 12 receive the message sent by PC1, but PC4 will not reply, as the destination MAC address is 00-01-33-33-33-33, only PC3 will reply to PC1. When port 12 receives the message sent by PC3, a mapping entry for MAC address 00-01-33-33-33-33 and port 12 is added to the MAC table.
4. Now the MAC table has two dynamic entries, MAC address 00-01-11-11-11-11 - port 5 and 00-01-33-33-33-33 -port 12.
5. After the communication between PC1 and PC3, the switch does not receive any message sent from PC1 and PC3. And the MAC address mapping entries in the MAC table are deleted after 300 seconds. The 300 seconds here is the default aging time for MAC address entry in DCS-3950 series switch. Aging time can be modified in DCS-3950 switch.

8.1.2 Forward or Filter

The switch will forward or filter received data frames according to the MAC table. Take the above figure as an example, assuming DCN switch have learnt the MAC address of PC1 and PC3, and the user manually configured the mapping relationship for PC2 and PC4 to ports. The MAC table of DCN switch will be:

MAC Address	Port number	Entry added by
00-01-11-11-11-11	5	Dynamic learning
00-01-22-22-22-22	5	Static configuration
00-01-33-33-33-33	12	Dynamic learning
00-01-44-44-44-44	12	Static configuration

1. Forward data according to the MAC table

If PC1 sends a message to PC3, the switch will forward the data received on port 5 from port 12.

2. Filter data according to the MAC table

If PC1 sends a message to PC2, the switch, on checking the MAC table, will find PC2 and PC1 are in the same physical segment and filter the message (i.e. drop this message).

Three types of frames can be forwarded by the switch:

- Broadcast frame
- Multicast frame
- Unicast frame

The following describes how the switch deals with all the three types of frames:

1. Broadcast frame: The switch can segregate collision domains but not broadcast domains. If no VLAN is set, all devices connected to the switch are in the same broadcast domain. When the switch receives a broadcast frame, it forwards the frame in all ports. When VLANs are configured in the switch, the MAC table will be adapted accordingly to add VLAN information. In this case, the switch will not forward the received broadcast frames in all ports, but forward the frames in all ports in the same VLAN.
2. Multicast frame: When IGMP Snooping function is not enabled, multicast frames are processed in the same way as broadcast frames; when IGMP Snooping is enabled, the switch will only forward the multicast frames to the ports belonging to the very multicast group.
3. Unicast frame: When no VLAN is configured, if the destination MAC addresses are in the switch MAC table, the switch will directly forward the frames to the associated ports; when the destination MAC address in a unicast frame is not found in the MAC table, the switch will broadcast the unicast frame. When VLANs are configured, the switch will forward unicast frame within the same VLAN. If the destination MAC address is found in the MAC table but belonging to different VLANs, the switch can only broadcast the unicast frame in the VLAN it belongs to.

8.2 MAC address table configuration Command List

8.2.1 mac-address-table aging-time

Command：mac-address-table aging-time {<*age*>| 0}
no mac-address-table aging-time

Function: Set the aging time for address mapping entries in the MAC table dynamically learnt; the '**no mac-address-table aging-time**' command restores the aging time to the default 300 seconds.

Parameter: < *age*> is the aging time in seconds, the valid range is 10 to 100000; 0 for no aging.
Command mode: Global Mode
Default: The system default aging time is 300 seconds.
Usage Guide: If the aging time for mac address table is too short, switch performance may be interfered by the unnecessary broadcasting. If the aging time is set too long, some entries in the address table can not be removed when they are not valid. Hence, the aging time should be carefully selected according to the actual situation.

If the aging time is set to 0, the aging for address entries will be disabled. And the mac address learned by the switch will always exist in the MAC address table.

To be mentioned, the actual aging time for MAC address entries will be 1~1.5 times of the value set by this command for DCS-3950 series switch. If no packets are received from the MAC address in the table, the address will be aged, and its corresponding entry in the address table will be removed.
Example: Set aging time for MAC address learning table to be 400 seconds.
Switch(Config)#mac-address-table aging-time 400

8.2.2 mac-address-table

Command：mac-address-table static address <*mac-addr*> vlan <*vlan-id* > interface [Ethernet|port-channel]<*interface-name*>
no mac-address-table [static |dynamic] [address <*mac-addr*>] [vlan <*vlan-id*>] [interface <*interface-name*>]
Function： Add or modify static address entries, The '**no mac-address-table [static |dynamic] [address <*mac-addr*>] [vlan <*vlan-id*>] [interface <*interface-name*>**'command deletes the static,dynamic and mac address table entries.
Parameter：static is the static entries; **<*mac-addr*>** MAC address to be added or deleted;**<*interface-name*>** name of the port transmitting the MAC data packet;**<*vlan-id*>** is the vlan number.
Command mode：Global Mode
Default：When VLAN or Layer 3 interface is configured and is up, the system will generate an static address mapping entry of which the inherent MAC address corresponds to the VLAN or Layer 3 interface.
Usage Guide：In certain special applications or when the switch is unable to dynamically learn the MAC address, users can use this command to manually establish mapping relation between the MAC address and port and VLAN. If the type of a port is **port-channel**, the port channel must be in the up state.
no mac-address-table command is for deleting all dynamic, static, filter MAC address entries existing in the switch MAC address list, except for the mapping entries retained in the system default.
Example：Port 0/0/5 belongs to VLAN200, and establishes address mapping with MAC address 00-03-0f-f0-00-18.
Switch(Config)#mac-address-table static address 00-03-0f-f0-00-18 vlan 200 interface

ethernet 0/0/5

8.2.3 mac-address-table blackhole

Command：mac-address-table blackhole address <*mac-addr*> vlan <*vlan-id* >
no mac-address-table blackhole [address <*mac-addr*>] [vlan <*vlan-id*>]
Function：Add or modify filtering address entries,the '**no mac-address-table blackhole [address <*mac-addr*>] [vlan <*vlan-id*>]' deletes** filtering address entries.
Parameter：<*mac-addr*> MAC address to be added or deleted; **<*vlan-id*>** receives vlan number of the MAC data packet
Command mode：Global Mode
Default：No filtering entries
Usage Guide: This command configures the address filter to drop packets from certain MAC address. It is used to filter the dataflow from some certain addresses. Both source addresses and destination addressed can be filtered. The filter table entries only filters VLAN and MAC addresses, and there's no impact on the ports.
Example: For VLAN 200, add the MAC address of 00-03-0f-f0-00-18 into the filter table.
Switch(Config)#mac-address-table blackhole address 00-03-0f-f0-00-18 vlan 200

8.2.4 clear mac-address-table dynamic

Command：clear mac-address-table dynamic [address <*hw_addr*>] [vlan <*vid*>] [interface {[ethernet|port-channel] <*Interfacename*>}]
Function：Delete dynamic address entries
Parameter：<*mac-addr*> MAC address to be deleted; **<*interface-name*>** name of the port transmitting the MAC data packet; **<*vlan-id*>** receives vlan number of the MAC data packet.
Command mode：Admin Mode
Default：None
Usage Guide: This command is used to remove entries in the dynamic MAC address table in the Admin Mode.
Example: Remove all dynamic MAC address entries in the MAC address table.
Switch# clear mac-address-table dynamic

8.3 Typical Configuration Example

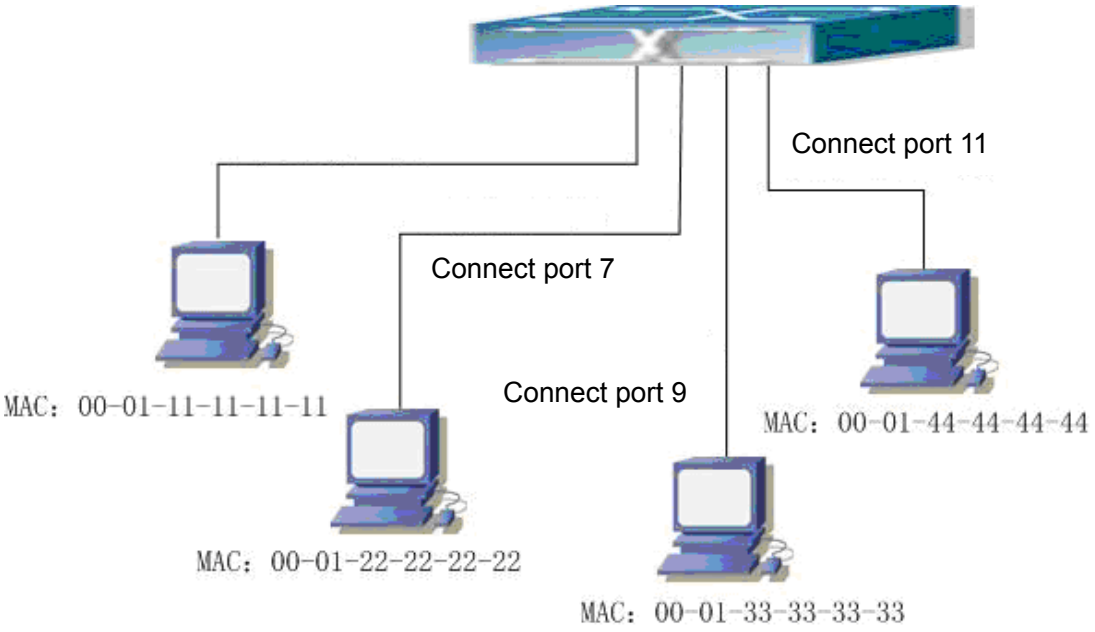


Fig 8-2 MAC address table configuration example

Scenario: Four PCs as shown in the above figure connect to port 5, 7, 9, 11 of switch, all the four PCs belong to the default VLAN1. As required by the network environment, dynamic learning is enabled. PC1 holds sensitive data and can not be accessed by any other PC that is in another physical segment; PC2 and PC3 have static mapping set to port 7 and port 9, respectively.

The configuration steps are listed below:

1. Set the MAC address 00-01-11-11-11-11 of PC1 as a filter address.
Switch(Config)#mac-address-table blackhole address 00-01-11-11-11-11 vlan 1
2. Set the static mapping relationship for PC2 and PC3 to port 7 and port 9, respectively.
Switch(Config)#mac-address-table static address 00-01-22-22-22-22 vlan 1 interface ethernet 0/0/7
Switch(Config)#mac-address-table static address 00-01-33-33-33-33 vlan 1 interface ethernet 0/0/9

8.4 Troubleshooting

8.4.1 Monitor and Debug Command List

8.4.1.1 show mac-address-table

Command: show mac-address-table [static|aging-time|blackhole|count] [address <*mac-addr*>] [vlan <*vlan-id*>] [interface <*interface-name*>]
Parameter: static entry; **aging-time** address aging time; **blackhole** filtering entry; **count** address counter; ***<mac-addr>*** entry's MAC address; ***<vlan-id>*** entry's VLAN number; ***<interface-name>*** entry's interface name
Command mode: Admin Mode
Default: MAC address table is not displayed by default.
Usage guide: This command can display various sorts of MAC address entries. Users can also use **show mac-address-table** to display all the MAC address entries.
Example: Display all the filter MAC address entries.
Switch#show mac-address-table blackhole

8.4.2 Troubleshooting

Using the show mac-address-table command, a port is found to be failed to learn the MAC of a device connected to it. Possible reasons:

- The connected cable is broken.
- Spanning Tree is enabled and the port is in 'discarding' status; or the device is just connected to the port and Spanning Tree is still under calculation, wait until the Spanning Tree calculation finishes, and the port will learn the MAC address.
- If not the problems mentioned above, please check for the switch port and contact technical support for solution.

8.5 MAC Address Function Extension

8.5.1 MAC Address Binding

8.5.1.1 Introduction to MAC Address Binding

Most switches support MAC address learning, each port can dynamically learn several MAC addresses, so that forwarding data streams between known MAC addresses within the ports can be achieved. If a MAC address is aged, the packet destined for that entry will be broadcasted. In other words, a MAC address learned in a port will be used for forwarding in that port, if the connection is changed to another port, the switch will learn the MAC address again to forward data in the new port.

However, in some cases, security or management policy may require MAC addresses to be bound with the ports, only data stream from the binding MAC are allowed to be forwarded in the ports. That is to say, after a MAC address is bound to a port, only

the data stream destined for that MAC address can flow in from the binding port, data stream destined for the other MAC addresses that not bound to the port will not be allowed to pass through the port.

8.5.1.2 MAC Address Binding Configuration

8.5.1.2.1 MAC Address Binding Configuration Task List

1. Enable MAC address binding function for the ports
2. Lock the MAC addresses for a port
3. MAC address binding property configuration

1. Enable MAC address binding function for the ports

Command	Explanation
Interface Mode	
switchport port-security **no switchport port-security**	Enable MAC address binding function;the' **no switchport port-security** command disables the MAC address binding function

2. Lock the MAC addresses for a port

Command	Explanation
Interface Mode	
switchport port-security lock **no switchport port-security lock**	Lock the port. After locking the port, no MAC address can be learnt. '**no switchport port-security lock**' resume the MAC address learning.
switchport port-security convert	Convert dynamic secure MAC addresses learned by the port to static secure MAC addresses.
switchport port-security timeout <*value*> **no switchport port-security timeout**	Enable port locking timer function; the '**no switchport port-security timeout**' restores the default setting.
switchport port-security mac-address <*mac-address*> **no switchport port-security mac-address <*mac-address*>**	Add static secure MAC address; the '**no switchport port-security mac-address <*mac-address*>'** command deletes static secure MAC address.
clear port-security dynamic [address <*mac-addr*> | interface <*interface-id*>]	Clear dynamic MAC addresses learned by the specified port.

3. MAC address binding property configuration

Command	Explanation
Interface Mode	

switchport port-security maximum <*value*> **no switchport port-security maximum <*value*>**	Set the maximum number of secure MAC addresses for a port; the '**no switchport port-security maximum <*value*>**' command restores the default value.
switchport port-security violation {protect | shutdown} **no switchport port-security violation**	Set the violation mode for the port; the ' **no switchport port-security violation** ' command restores the default setting.

8.5.1.2.2 Mac Address Binding configuration Command List

8.5.1.2.2.1 switchport port-security

Command: switchport port-security
no switchport port-security
Function: Enable MAC address binding function. The '**no switchport-security'** command disables the MAC address binding function for the port and restores the MAC address learning function for the port.
Command mode: Interface Mode
Default: MAC address binding is not enabled by default.
Usage Guide: The MAC address binding function, Spanning Tree and Port Aggregation functions are mutually exclusive. Therefore, if MAC binding function for a port is to be enabled, the Spanning Tree and Port Aggregation functions must be disabled, and the port enabling MAC address binding must not be a Trunk port.
Example: Enable MAC address binding function for port 1.
Switch(Config)#interface Ethernet 0/0/1
Switch(Config-Ethernet0/0/1)#switchport port-security

8.5.1.2.2.2 switchport port-security convert

Command: switchport port-security convert
Function: Convert dynamic secure MAC addresses learned by the port to static secure MAC addresses.
Command mode: Interface Mode
Usage Guide: The port dynamic MAC convert command can only be executed after the secure port is locked. After this command has been executed, dynamic secure MAC addresses learned by the port will be converted to static secure MAC addresses. The command does not reserve configuration.
Example: Converting MAC addresses in port 1 to static secure MAC addresses.
Switch(Config)#interface Ethernet 0/0/1
Switch(Config-Ethernet0/0/1)#switchport port-security convert

8.5.1.2.2.3 switchport port-security lock

Command: switchport port-security lock

no switchport port-security lock

Function: Lock down the specified port. If a port is locked, the MAC address learning of the port will be disabled. If no is put in front of this command, MAC address learning will be restored.

Command mode: Interface Mode.

Default: All interfaces are not locked by default.

Usage Guide: This command is only available when the MAC address binding function of the port has been enabled. When a port is locked, the dynamic learning of MAC addresses for the port will be disabled.

Example: Lock port 0/0/1.

Switch(Config)#interface Ethernet 0/0/1

Switch(Config-Ethernet0/0/1)#switchport port-security lock

8.5.1.2.2.4 switchport port-security timeout

Command: switchport port-security timeout <*value*>

no switchport port-security timeout

Function: Set the timer for port locking; the '**no switchport port-security timeout**' command restores the default setting.

Parameter: < *value*> is the timeout value, the valid range is 0 to 300s.

Command mode: Interface Mode

Default: Port locking timer is not enabled by default.

Usage Guide: The port locking timer function is a dynamic MAC address locking function. MAC address locking and conversion of dynamic MAC entries to secure address entries will be performed on locking timer timeout. The MAC address binding function must be enabled prior to running this command.

Example: Set port1 locking timer to 30 seconds.

Switch(Config)#interface Ethernet 0/0/1

Switch(Config-Ethernet0/0/1)# switchport port-security timeout 30

8.5.1.2.2.5 switchport port-security mac-address

Command: switchport port-security mac-address <*mac-address*>

no switchport port-security mac-address <*mac-address*>

Function: Add a static secure MAC address; the '**no port-security mac-address'** command deletes a static secure MAC address.

Command mode: Interface Mode

Parameters: <*mac-address*> stands for the MAC address to be added/deleted.

Usage Guide: The MAC address binding function must be enabled before static secure MAC address can be added.

Example: Add MAC 00-03-0F-FE-2E-D3 to port1.

Switch(Config)#interface Ethernet 0/0/1

Switch(Config-Ethernet0/0/1)#switchport port-security mac-address 00-03-0F-FE-2E-D3

8.5.1.2.2.6 clear port-security dynamic

Command: clear port-security dynamic [address <*mac-addr*>|interface <*interface-id*>]

Function: Clear the Dynamic MAC addresses of the specified port.

Command mode: Admin Mode

Parameters: <*mac-addr*> stands MAC address; **<*interface-id*>** for specified port number.

Usage Guide: The secure port must be locked before dynamic MAC clearing operation can be performed in specified port. If no ports and MAC are specified, then all dynamic MAC in all locked secure ports will be cleared; if only port but no MAC address is specified, then all MAC addresses in the specified port will be cleared.

Example: Delete all dynamic MAC in port1.

Switch#clear port-security dynamic interface Ethernet 0/0/1

8.5.1.2.2.7 switchport port-security maximum

Command: switchport port-security maximum <*value*>
no switchport port-security maximum

Function: Set the maximum number of secure MAC addresses for a port; the '**no switchport port-security maximum**' command restores the maximum secure address number of 1.

Command mode: Interface Mode

Parameters: < *value*> is the up limit for static secure MAC address, the valid range is 1 to 128.

Default: The default maximum port secure MAC address number is 1.

Usage Guide: The MAC address binding function must be enabled before maximum secure MAC address number can be set. If secure static MAC address number of the port is larger than the maximum secure MAC address number set, the setting fails; extra secure static MAC addresses must be deleted, so that the secure static MAC address number is no larger than the maximum secure MAC address number for the setting to be successful.

Example: Set the maximum secure MAC address number for port 1 to 4.

Switch(Config)#interface Ethernet 0/0/1

Switch(Config-Ethernet0/0/1)#switchport port-security maximum 4

8.5.1.2.2.8 switchport port-security violation

Command：switchport port-security violation {protect|shutdown}
no switchport port-security violation

Function：Configure the port violation mode. The '**no switchport port-security violation**' restores the violation mode to protect mode.

Command mode： Interface Mode

Parameters：protect refers to protect mode; **shutdown** refers to shutdown mode

Default： The port violation mode is **protect** by default

Usage Guide： The port violation mode configuration is only available after the MAC

address binding function is enabled. when the port secure MAC address exceeds the security MAC limit, if the violation mode is **protect**, the port only disable the dynamic MAC address learning function; while the port will be shut if at **shutdown** mode. Users can manually open the port with **no shutdown** command.

Example： Set the violation mode of port 0/0/1 to shutdown

Switch(Config)#interface Ethernet 0/0/1

Switch(Config-Ethernet0/0/1)#switchport port-security violation shutdown

8.5.1.3 MAC Address Binding Troubleshooting

8.5.1.3.1 MAC Address Binding Monitor and Debug Command List

8.5.1.3.1.1 show port-security

Command: show port-security

Function: Display the secure MAC addresses of the port.

Command mode: Admin Mode

Default: Configuration of secure ports is not displayed by default.

Usage Guide: This command displays the detailed configuration information for the secure port.

Example:

Switch#show port-security

Security Port	MaxSecurityAddr (count)	CurrentAddr (count)	Security Action
Ethernet0/0/3	1	1	Protect
Ethernet0/0/4	10	1	Protect
Ethernet0/0/5	1	0	Protect

Total Addresses in System :2

Max Addresses limit in System :128

Items	Notes
Security Port	The VLAN ID for the secure MAC Address
MaxSecurityAddr	Maximum number of security addresses.
CurrentAddr	Current MAC address for the security port.
Security Action	Security action for the port.
Total Addresses in System	Current secure MAC address number in the system.
Max Addresses limit in System	Maximum secure MAC address limit in the system.

8.5.1.3.1.2 show port-security interface

Command: show port-security interface <interface-id>
Function: Display the secure MAC addresses of the port.
Command mode: Admin Mode
Parameter: *<interface-id>*stands for the port to be displayed
Default: Configuration of Security Port is not be displayed
Usage Guide: This command displays the detailed configuration information for the secure port.
Example:
Switch#show port-security interface ethernet 0/0/1
Port Security :Enabled
Port status :Security Up
Violation mode :Protect
Maximum MAC Addresses :1
Total MAC Addresses :1
Configured MAC Addresses :1
Lock Timer is ShutDown
Mac-Learning function is : Opened

Items	Notes
Port Security :	Whether the port security has been enabled.
Port status :	Port security status.
Violation mode :	Violation mode set for the port.
Maximum MAC Addresses :	The maximum number of secure MAC address number set for the port
Total MAC Addresses :	Current secure MAC address number for the port.
Configured MAC Addresses :	Current secure static MAC address number for the port
Lock Timer	Whether locking timer (timer timeout) is enabled for the port.
Mac-Learning function	Whether the MAC learning function has been enabled or not.

8.5.1.3.1.3 show port-security address

Command：show port-security address [interface <interface-id>]
Function: Display the secure MAC addresses of the port.
Command mode: Admin Mode
Parameter: *<interface-id>* stands for the port to be displayed.
Usage Guide: This command displays the secure port MAC address information, if no port is specified, secure MAC addresses of all ports are displayed.
Switch#show port-security address interface ethernet 0/0/1
Security Mac Address Table

Vlan	Mac Address	Type	Ports
1	0000.0000.1111	SecureConfigured	Ethernet0/0/3

Total Addresses :1

Items	Notes
Vlan	The VLAN ID for the secure MAC Address
Mac Address	Secure MAC address
Type	Secure MAC address type
Ports	The port that the secure MAC address belongs to
Total Addresses	Current secure MAC address number in the system.

8.5.1.3.2 MAC Address Binding Troubleshooting

Enabling MAC address binding for ports may fail in some occasions. Here are some possible causes and solutions:

- ☞ If MAC address binding cannot be enabled for a port, make sure the port is not enabling Spanning tree or port aggregation and is not configured as a Trunk port. MAC address binding is exclusive to such configurations. If MAC address binding is to be enabled, the functions mentioned above must be disabled first.
- ☞ If a secure address is set as static address and deleted, that secure address will be unusable even though it exists. For this reason, it is recommended to avoid static address for ports enabling MAC address
- ☞ Users might find that some devices connected to the ports configured with MAC address binding function can not transmit data. If so, please check whether the MAC addresses of these devices has been transformed into secure MAC, if not, even the switch has learnt the MAC addresses of these devices, they can not transmit data, because only secure MAC can transmit data when the ports has enabled the MAC address binding function.

Chapter 9 VLAN Configuration

9.1 Introduction to VLAN

VLAN (Virtual Local Area Network) is a technology that divides the logical addresses of devices within the network to separate network segments basing on functions, applications or management requirements. By this way, virtual workgroups can be formed regardless of the physical location of the devices. IEEE announced IEEE 802.1Q protocol to direct the standardized VLAN implementation, and the VLAN function of DCS-3950 series switch is implemented following IEEE 802.1Q.

The key idea of VLAN technology is that a large LAN can be partitioned into many separate broadcast domains dynamically to meet the demands.

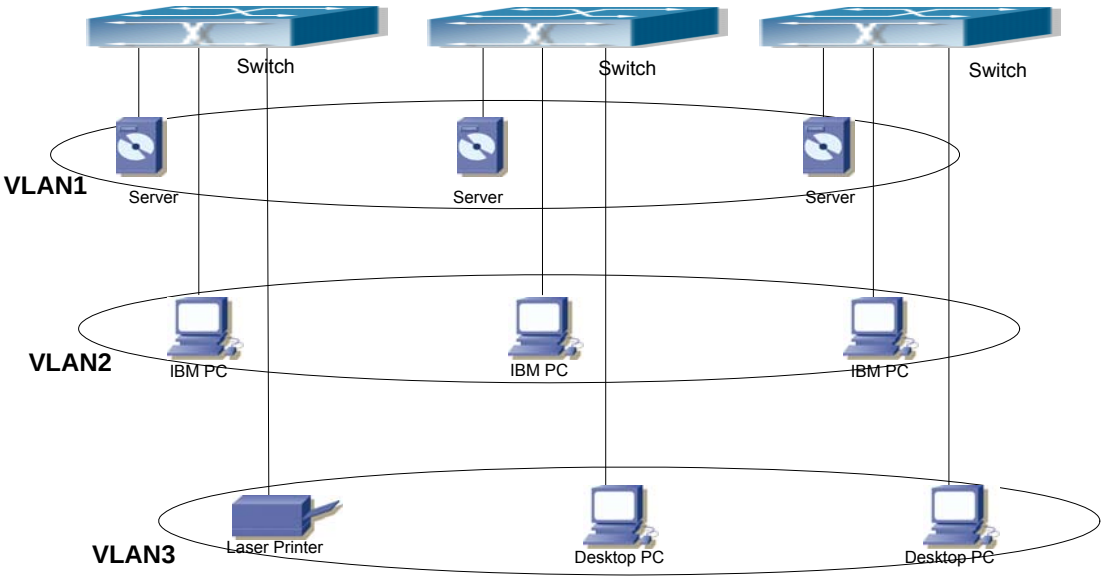


Fig 9-1 A VLAN network defined logically

Each broadcast domain is a VLAN. VLANs have the same properties as the physical LANs, except VLAN is a logical partition rather than physical one. Therefore, the partition of VLANs can be performed regardless of physical locations, and the broadcast, multicast and unicast traffic within a VLAN is separated from the other VLANs.

With the aforementioned features, VLAN technology provides us with the following convenience:

- Improving network performance
- Saving network resources
- Simplifying Network Management
- Lowering network cost

- Enhancing network security

VLAN and GVRP (GARP VLAN Registration Protocol) defined by 802.1Q are implemented in DCS-3950 series switch. The chapter will describe the use and configuration of VLAN and GVRP in details.

9.2 VLAN Configuration

9.2.1 VLAN Configuration Task List

1. Creating or deleting VLAN
2. Specifying or deleting name of VLAN
3. Assigning Switch ports for VLAN
4. Set The Switch Port Type
5. Set Trunk port
6. Set Access port
7. Enable/Disable VLAN ingress rules on ports
8. Configure Private VLAN
9. Set Private VLAN association

1. Creating or deleting VLAN

Command	Explanation
Global Mode	
vlan <*vlan-id*> **no vlan <*vlan-id*>**	Create/delete VLAN or enter VLAN Mode

2. Specifying or deleting name of VLAN

Command	Explanation
Global Mode	
name <*vlan-name*> **no name**	Specifying or deleting name of VLAN

3. Assigning Switch ports for VLAN

Command	Explanation
VLAN Mode	
switchport interface <*interface-list*> **no switchport interface <*interface-list*>**	Assign Switch ports to VLAN

4. Set the Switch Port Type

Command	Explanation
Interface Mode	
switchport mode {trunk|access}	Set the current port as Trunk or Access port.

5. Set Trunk port

Command	Explanation
Interface Mode	
switchport trunk allowed vlan {<*vlan-list*>|all} **no switchport trunk allowed vlan <*vlan-list*>**	Set/delete VLAN allowed to be crossed by Trunk. The 'no' command restores the default setting.
switchport trunk native vlan <*vlan-id*> **no switchport trunk native vlan**	Set/delete PVID for Trunk port.

6. Set Access port

Command	Explanation
Interface Mode	
switchport access vlan <*vlan-id*> **no switchport access vlan**	Add the current port to specified VLAN the specified VLANs.

7. Disable/Enable VLAN Ingress Rules

Command	Explanation
Global Mode	
switchport ingress-filtering **no switchport ingress-filtering**	Disable/Enable VLAN ingress rules

8. Configure Private VLAN

Command	Explanation
VLAN mode	
private-vlan {primary|isolated|community} **no private-vlan**	Configure current VLAN to Private VLAN

9. Set Private VLAN association

Command	Explanation
VLAN mode	

private-vlan association <*secondary-vlan-list*> no private-vlan association	Set/delete Private VLAN association

9.2.2 VLAN Configuration Command List

9.2.2.1 vlan

Command: vlan <*vlan-id*>
no vlan <*vlan-id*>
Function: Create VLAN and enter the VLAN configuration mode. In VLAN mode, VLAN names can be set, and interface belonging to the VLAN can be specified. If no is put in front of the command, specified VLAN will be removed.
Parameters: <*vlan-id*> is the VID for the VLAN to be created or removed. It's limited to 1~4094.
Command mode: Global Mode.
Default: Only VLAN1 is configured by default.
Usage Guide: VLAN1 is the default VLAN in the system which can not be removed. The maximum number of VLANs that can be configured is 4094.
Example: Create a VLAN with 100 as the vlan-id, and enter the VLAN configuration mode.
Switch(Config)#vlan 100
Switch(Config-Vlan100)#

9.2.2.2 name

Command: name <*vlan-name*>
no name
Function: Specify a name for the VLAN. VLAN name is a description string for the VLAN. If no is put in front of the command, the VLAN name will be removed.
Parameters: <*vlan-name*> is the name description string for the VLAN.
Command mode: VLAN configuration mode
Default: The name of VLAN will be **VLANXXX**, in which **XXX** denotes for the VID.
Usage: It is supported to give the specified VLAN a name string to describe and memorize the VLAN.
Example: Give VLAN100 name description as TestVlan.
Switch(Config-Vlan100)#name TestVlan

9.2.2.3 switchport access vlan

Command: switchport access vlan <*vlan-id*>
no switchport access vlan
Function: Add the current access port of the switch to the specified VLAN. If no is put in

front of the command, the specified port will be removed from the VLAN.
Parameters: <*vlan-id*> is for the VLAN ID of the port to be added to the VLAN, which is limited between 1 and 4094.
Command mode: Port Mode.
Default: All the switch ports belong to VLAN1 by default.
Usage Guide: Only the access port on the switch can be added to the specified VLAN. And one access port can be added to only one VLAN at the same time.
Example: Add the specified port to VLAN100.
Switch(Config)#interface ethernet 0/0/8
Switch(Config-ethernet0/0/8)#switchport mode access
Switch(Config-ethernet0/0/8)#switchport access vlan 100
Switch(Config-ethernet0/0/8)#exit

9.2.2.4 switchport interface

Command: switchport interface <*interface-list*>
no switchport interface <*interface-list*>
Function: Add an ethernet interface to a VLAN. If no is put in front of this command, the specified ethernet interface will be removed from the VLAN.
Parameters: <*interface-list*> is the list of interfaces to be added to or removed from the VLAN which can be separated by ';' or '-'. For example, ethernet 0/0/1;2;5 or ethernet 0/0/1-6;8.
Command mode: VLAN configuration mode.
Default: No port will be contained in a newly created VLAN by default.
Usage Guide: Access port of the switch is normal port, which can be added to one and only one VLAN.
Example: Add ethernet 0/0/1;3;4-7;8 to VLAN100.
Switch(Config-Vlan100)#switchport interface ethernet 0/0/1;3;4-7;8

9.2.2.5 switchport mode

Command: switchport mode {trunk|access}
Function: Configure the port as trunk mode or access mode.
Parameters; *trunk* enables the port for transmission of packets from multiple VLANs. ***access*** configures the port to be able to belong to only one VLAN.
Command mode: Port Mode.
Default: The port is in access mode by default.
Usage Guide: Ports configured as trunk mode is called trunk ports, while port working in access mode is called access ports. For trunk ports, packets from multiple VLANs can be transferred, which can be used to connect the same VLAN from different switches. For access ports, one and only one VLAN can be configured for the VLAN.
Notice: 802.1X authentication is disabled for trunk ports.
Example: Configure port 5 in trunk mode, and port 8 in access mode.
Switch(Config)#interface ethernet 0/0/5

```
Switch(Config-ethernet0/0/5)#switchport mode trunk
Switch(Config-ethernet0/0/5)#exit
Switch(Config)#interface ethernet 0/0/8
Switch(Config-ethernet0/0/8)#switchport mode access
Switch(Config-ethernet0/0/8)#exit
```

9.2.2.6 switchport trunk allowed vlan

Command: switchport trunk allowed vlan {<*vlan-list*>|all}
no switchport trunk allowed vlan

Function: Configure VLAN lists that can go through the trunk port. If no is put in front of the command, default values will be recovered.

Parameters: <*vlan-list*> is the list for VLANs of which the packets can go through the trunk port. **<*all*>** configures the trunk port to allow any packets in any VLANs to go through.

Command mode: Port Mode.

Default: It is configured by default that any VLAN can go through the trunk port.

Usage Guide: Packets from which VLAN can go through the trunk port can be configured through this command. And for VLANs that are not configured, packets from the VLAN will be dropped.

Example: Configure port 5 to be in trunk mode. And make packets from VLAN 1, 3, 5,20 can go through the port.

```
Switch(Config)#interface ethernet 0/0/5
Switch(Config-ethernet0/0/5)#switchport mode trunk
Switch(Config-ethernet0/0/5)#switchport trunk allowed vlan 1;3;5-20
Switch(Config-ethernet0/0/5)#exit
```

9.2.2.7 switchport trunk native vlan

Command: switchport trunk native vlan <*vlan-id*>
no switchport trunk native vlan

Function: Configure the PVID for the trunk port. If no is put in front of the command, default values will be restored.

Parameters: <*vlan-id*> is the PVID for the trunk port.

Command mode: Port Mode.

Default: The default PVID for a trunk port is 1.

Usage Guide: PVID is defined in the 802.1Q standard. When a untagged frame is received by the trunk port, The frame will be attached with the tag which is specified as the native PVID in this command before the frame is forwarded.

Example: Configure the native PVID to be 100 for ethernet 0/0/5.

```
Switch(Config)#interface ethernet 0/0/5
Switch(Config-ethernet0/0/5)#switchport mode trunk
Switch(Config-ethernet0/0/5)#switchport trunk native vlan 100
Switch(Config-ethernet0/0/5)#exit
```

9.2.2.8 vlan ingress enable

Command: vlan ingress enable
no vlan ingress enable
Function: Enable the ingress rull for the VLAN, If no is put in front of the command, ingress rull well be disabled.
Command mode: Port Mode.
Default: The ingress rule is disabled by default.
Usage Guide: If the ingress rule for the VLAN is enabled, the switch will check for each frame for the VLAN membership. If the port from which the frame comes belongs to the VLAN, the frame will be received and forwarded. Otherwise, it will be dropped.
Example: Enable the ingress rule for the port.
Switch(Config-Ethernet0/0/1)# vlan ingress enable

9.2.2.9 private-vlan

Command: private-vlan {primary|isolated|community}
no private-vlan
Function: Configure the current VLAN as Private VLAN, If no is put in front of this command, Private VLAN configuration will be removed.
Parameters: primary is to set current VLAN as Primary VLAN, isolated is to set current VLAN as Isolated VLAN. community is to set current VLAN as Community VLAN.
Command mode: VLAN configuration mode.
Default: Private VLAN configuration is not enabled by default.
Usage Guide: Only VLANs containing empty Ethernet ports can be set to Private VLAN, and only the Private VLANs configured with associated private relationships can set the Access Ethernet ports their member ports. Normal VLAN will clear its Ethernet ports when set to Private VLAN.
It is to be noted Private VLAN messages will not be transmitted by GVRP.
Example: Set VLAN100 as primary, VLAN200 as isolated, and VLAN300 as community.
Switch(Config)#vlan 100
Switch(Config-Vlan100)#private-vlan primary
Switch(Config-Vlan100)#exit
Switch(Config)#vlan 200
Switch(Config-Vlan200)#private-vlan isolated
Switch(Config-Vlan200)#exit
Switch(Config)#vlan 300
Switch(Config-Vlan300)#private-vlan community
Switch(Config-Vlan300)#exit

9.2.2.10 private-vlan association

Command: private-vlan association <*secondary-vlan-list*>
no private-vlan association

Function: Set association of Private VLAN. If no is put in front of the command, Private VLAN association will be removed.
Parameters: ***<secondary-vlan-list>*** is the list of Secondary VLANs which are associated with the Primary VLAN. There can be two kinds of Secondary VLAN, the Isolated VLAN and the Community VLAN. And multiple VLANs can be separated by ';'
Command mode: VLAN configuration mode.
Default: No association for Private VLAN is defined by default.
Usage Guide: Before setting Private VLAN association, three types of Private VLANs should have no member ports; the Private VLAN with Private VLAN association can't be deleted. When users delete Private VLAN association, all the member ports in the Private VLANs whose association is deleted are removed from the Private VLANs.
Example: Associate the Isolated VLAN200, and the Community VLAN300 to the Primary VLAN100.
Switch(Config-Vlan100)#private-vlan association 200;300

9.2.3 Typical VLAN Application

Scenario:

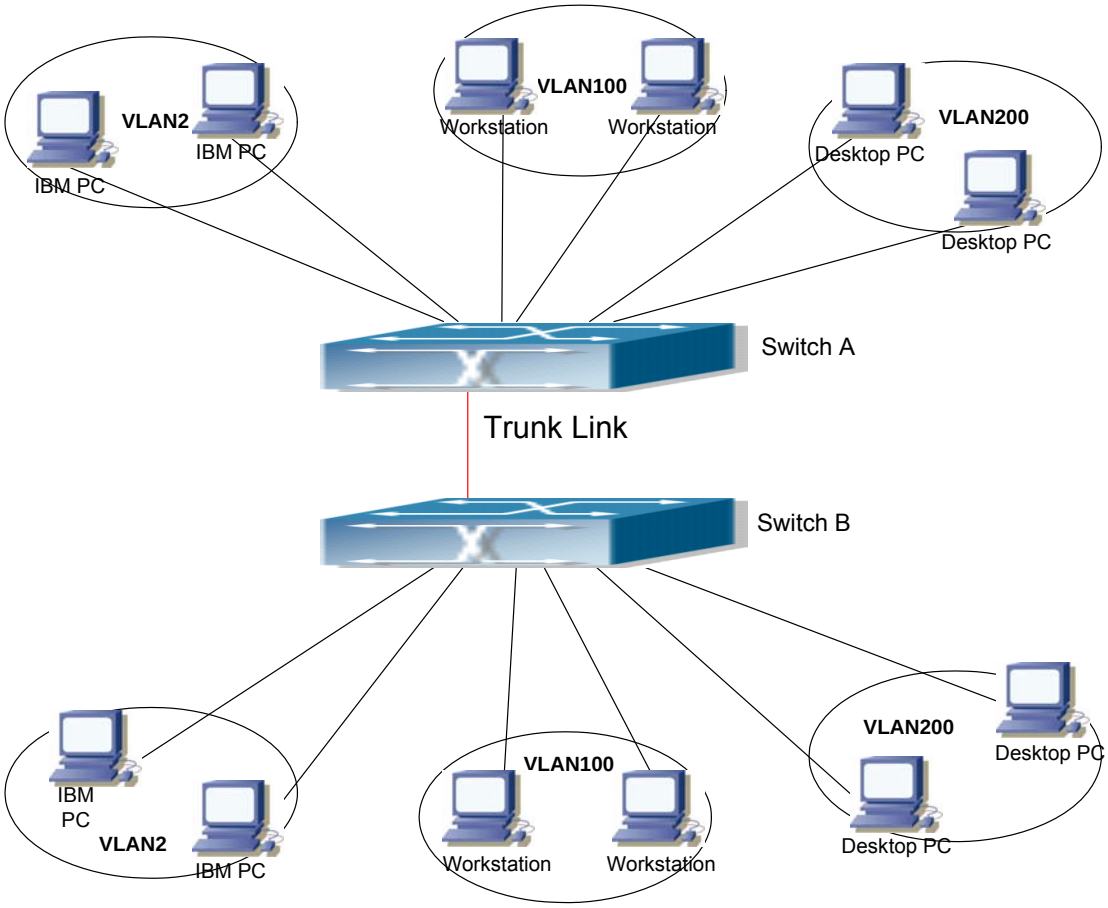


Fig 9-2 Typical VLAN Application Topology

The existing LAN is required to be partitioned to 3 VLANs due to security and application requirements. The three VLANs are VLAN2, VLAN100 and VLAN200. Those three VLANs are cross two different location A and B. One switch is placed in each site, and cross-location requirement can be met if VLAN traffic can be transferred between the two switches.

Configuration Item	Configuration description
VLAN2	Site A and site B switch port 2 -8.
VLAN100	Site A and site B switch port 9 -15.
VLAN200	Site A and site B switch port 16 -22.
Trunk port	Site A and site B switch port 23.

Connect the Trunk ports of both switches for a Trunk link to convey the cross-switch VLAN traffic; connect all network devices to the other ports of corresponding VLANs.

In this example, port 1 and port 24 is spared and can be used for management port or for other purposes.

The configuration steps are listed below:
Switch A:
Switch(Config)#vlan 2
Switch(Config-Vlan2)#switchport interface ethernet 0/0/2-8
Switch(Config-Vlan2)#exit
Switch(Config)#vlan 100
Switch(Config-Vlan100)#switchport interface ethernet 0/0/9-15
Switch(Config-Vlan100)#exit
Switch(Config)#vlan 200
Switch(Config-Vlan200)#switchport interface ethernet 0/0/16-22
Switch(Config-Vlan200)#exit
Switch(Config)#interface ethernet 0/0/23
Switch(Config-Ethernet0/0/23)#switchport mode trunk
Switch(Config-Ethernet0/0/23)#exit
Switch(Config)#
Switch B:
Switch(Config)#vlan 2
Switch(Config-Vlan2)#switchport interface ethernet 0/0/2-8
Switch(Config-Vlan2)#exit
Switch(Config)#vlan 100
Switch(Config-Vlan100)#switchport interface ethernet 0/0/9-15
Switch(Config-Vlan100)#exit
Switch(Config)#vlan 200
Switch(Config-Vlan200)#switchport interface ethernet 0/0/16-22
Switch(Config-Vlan200)#exit
Switch(Config)#interface ethernet 0/0/23
Switch(Config-Ethernet0/0/23)#switchport mode trunk
Switch(Config-Ethernet0/0/23)#exit

9.3 Dot1q-tunnel Configuration

9.3.1 Dot1q-tunnel Introduction

Dot1q-tunnel is also called QinQ (802.1Q-in-802.1Q), which is an expansion of 802.1Q. Its dominating idea is encapsulating the customer VLAN tag (CVLAN tag) to the service provider VLAN tag (SPVLAN tag). Carrying the two VLAN tags the packet is transmitted through the backbone network of the ISP internet, so to provide a simple layer-2 tunnel for the users. It is simple and easy to manage, applicable only by static configuration, and especially adaptive to small office network or small scale metropolitan area network using layer-3 switch as backbone equipment.

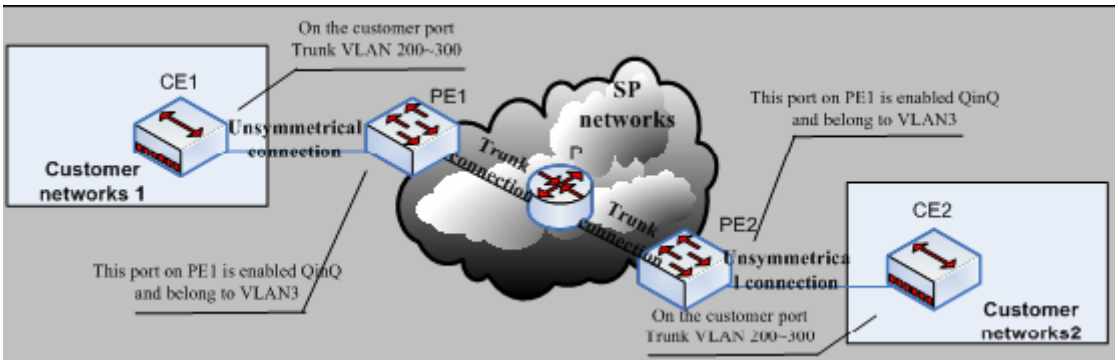


Figure 9-3Typical VLAN Application Topology

As shown in Fig 9-3, after being enabled on the user port, dot1q-tunnel assigns each user a SPVLAN identification (SPVID). Here the identification of user is 3. Same SPVID should be assigned for the same network user on different PEs. When packet reaches PE1 from CE1, it carries the VLAN tag 200-300 of the user internal network. Since the dot1q-tunnel function is enabled, the user port on PE1 will add on the packet another VLAN tag, of which the ID is the SPVID assigned to the user. Afterwards, the packet will only be transmitted in VLAN3 when traveling in the ISP internet network while carrying two VLAN tags (the inner tag is added when entering PE1, and the outer is SPVID), whereas the VLAN information of the user network is open to the provider network. When the packet reaches PE2 and before being forwarded to CE2 from the client port on PE2, the outer VLAN tag is removed, and then the packet CE2 receives is absolutely identical to the one sent by CE1. For the user, the role the operator network plays between PE1 and PE2,is to provide a reliable layer-2 link.

The technology of Dot1q-tuunel provides the ISP internet the ability of supporting many client VLANs by only one VLAN of theirselves. Both the ISP internet and the clients can configure their own VLAN independently.

It is obvious that, the dot1q-tunnel function has got following characteristics:

- Applicable through simple static configuration, no complex configuration or maintenance to be needed.
- Operators will only have to assign one SPVID for each user, which increases the number of concurrent supportable users; while the users has got the ultimate freedom in selecting and managing the VLAN IDs (select within 1~4096 at users' will).
- The user network is considerably independent. When the ISP internet is upgrading their network, the user networks do not have to change their original configuration.

Detailed description on the application and configuration of dot1q-tunnel of DCS-3950 series will be provided in this section

9.3.2 Dot1q-Tunnel Configuration Task List

1. Configure the dot1q-tunnel function on the ports
2. Configure the type of protocol (TPID) on the ports
3. Configure the dot1q-tunnel type of the port.

1. Configure the dot1q-tunnel function on the ports

Command	Explanation
Port mode	
dot1q-tunnel enable **no dot1q-tunnel enable**	Enter/exit the dot1q-tunnel mode on the ports.

2. Configure the type of protocol (TPID) of the port

Command	Explanation
Port mode	
dot1q-tunnel tpid {8100|9100|9200}	Configure the type of protocol on the ports.

3. Set the dot1q-tunnel type of the port

Command	Explanation
Interface configuration mode	
switchport dot1q-tunnel mode {customer |uplink} **no switchport dot1q-tunnel**	Set the dot1q-tunnel type of the port

9.3.3 Dot1q-tunnel Command List

9.3.3.1 dot1q-tunnel enable

Command: dot1q-tunnel enable
no dot1q-tunnel enable
Function: Set the access port of the switch to dot1q-tunnel mode; the '**no dot1q-tunnel enable**' command restores to default.
Parameter: None.
Commandmode: Global Mode.
Default: Dot1q-tunnel function disabled on the port by default.
Usage Guide: The switch can use dot1q-tunnel function after enable this command.
Example: Enable dot1q-tunnel function
Switch(Config)#dot1q-tunnel enable

9.3.3.2 dot1q-tunnel tpid

Command: dot1q-tunnel tpid {8100|9100|9200}

Function: Configure the type (TPID) of the protocol of switch trunk port.
Parameter: None.
Command mode: Global Mode.
Default: TPID on the port is defaulted at 8100.
Usage Guide: This function is to facilitate internetworking with equipments of other manufacturers. If the equipment connected with the switch trunk port sends data packet with a TPID of 9100, the port TPID will be set to 9100, Then switch will receive and process data packets normally.
Example: Configure the TPID for the switch to be 9100
Switch(Config)#dot1q-tunnel tpid 9100

9.3.3.3 switchport dot1q-tunnel

Command: switchport dot1q-tunnel mode {customer|uplink}
no switchport dot1q-tunnel
Function: Configure the working mode for dot1q tunnel for the port.
Parameters: None.
Command mode: Port Mode.
Default: dot1q tunnel is disabled by default.
Usage Guide: This command can be configured in the port mode when the dot1q- tunnel is enabled in the global mode. The customer mode is used to allow VLANs from customers, and should be configured in the access ports. While the uplink mode is used to connect to operator's network, and should be configured in the trunk port. For packets without VLAN IDs coming from the customer ports, upper layer tags will be attached. For packets with VLAN IDs, outer layer VLAN IDs will be attached. VLAN ID is the ID that the port belongs to. For packets sent out from the ports in uplink mode, TPID will be attached as the tag. For packets with double tags, the forwarding will be determined by the MAC address and outer tags.
Example: Configure the port 1 in VLAN 3 to be in customer mode to connect with customer's network, then configure the port 25 to be uplink mode to connect with operator's network.
Switch(Config)#vlan 3
Switch(Config-Vlan3)#switchport interface ethernet 0/0/1
Switch (Config-Vlan3)#exit
Switch (Config)#dot1q-tunnel enable
Switch (Config)#interface ethernet 0/0/1
Switch (Config-Ethernet0/0/1)#switchport dot1q-tunnel mode customer
Switch (Config-Ethernet0/0/1)# exit
Switch (Config)#interface ethernet 0/0/25
Switch (Config-Ethernet0/0/25)#switchport mode trunk
Switch (Config-Ethernet0/0/25)#switchport dot1q-tunnel mode uplink
Switch (Config-Ethernet0/0/25)#exit
Switch (Config)#

9.3.3.4 show dot1q-tunnel

Command: show dot1q-tunnel
Function: Display the information of all the ports at dot1q-tunnel state.
Parameters: None.
Command mode: Admin Mode.
Usage Guide: This command is used for displaying the information of the ports at dot1q-tunnel state.
Example: Display current dot1q-tunnel state.

```
Switch#show dot1q-tunnel
Tpid: 9100
Port                Type
------------        --------
Ethernet0/0/1       Customer
Ethernet0/0/20      Uplink
```

9.3.4 Typical Applications of the Dot1q-tunnel

Scenario

ISP internet edge switch PE1 and PE2 forward the VLAN200~300 data between CE1 and CE2 of the client network with VLAN3. The port1 of PE1 is connected to CE1, port10 is connected to public network, the TPID of the connected equipment is 9100; port1 of PE2 is connected to CE2, port10 is connected to public network

Configuration Item	Configuration Explanation
VLAN3	Port1 of PE1 and PE2
dot1q-tunnel	Port1 of PE1 and PE2
tpid	Port10 of PE1
Trunk port	Port10 of PE1 and PE2

Configuration procedure is as follows:

PE1:

```
DCS-3950 (Config)#vlan 3
DCS-3950 (Config-Vlan3)#switchport interface ethernet 0/0/1
DCS-3950 (Config-Vlan3)#exit
DCS-3950 (Config)#dot1q-tunnel enable
DCS-3950 (Config)#dot1q-tunnel tpid 9100
DCS-3950 (Config)#interface ethernet 0/0/1
DCS-3950 (Config-Ethernet0/0/1)#switchport dot1q-tunnel mode customer
DCS-3950 (Config-Ethernet0/0/1)#exit
DCS-3950 (Config)#interface ethernet 0/0/10
DCS-3950 (Config-Ethernet0/0/10)#switchport mode trunk
DCS-3950 (Config-Ethernet0/0/10)#switchport dot1q-tunnel mode uplink
```

```
DCS-3950 (Config-Ethernet0/0/10)#exit
DCS-3950 (Config)#
```
PE2:
```
DCS-3950 (Config)#vlan 3
DCS-3950 (Config-Vlan3)#switchport interface ethernet 0/0/1
DCS-3950 (Config-Vlan3)#exit
DCS-3950 (Config)#dot1q-tunnel enable
DCS-3950 (Config)#interface ethernet 0/0/1
DCS-3950 (Config-Ethernet0/0/1)#switchport dot1q-tunnel mode customer
DCS-3950 (Config-Ethernet0/0/1)#exit
DCS-3950 (Config)#interface ethernet 0/0/10
DCS-3950 (Config-Ethernet0/0/10)#switchport mode trunk
DCS-3950 (Config-Ethernet0/0/10)#switchport dot1q-tunnel mode uplink
DCS-3950 (Config-Ethernet0/0/10)#exit
DCS-3950 (Config)#
```

9.3.5 Dot1q-tunnel Troubleshooting

- This function cannot be used simultaneously with private-vlan（refer to session 9.2.2.9）.
- Customer port mode has to be configured on access ports, while the uplink port mode has to be configured on trunk ports.
- It is recommened that using the uplink pord mode on 1000bps ports to reach the expected transimission rate of uplink ports and guarantee the high-speed operation of network.

9.4 Protocol VLAN Configuration

9.4.1 Protocol VLAN Introduction

To be simple and clear, Protocol VLAN mirrors packets without tags to VLAN according to their protocol types, instead of determining their VLAN identity according to the physical ports of the switches they connect to. After configuring the Protocol VLAN, the switch will check the packets received on the ports, designating a VLAN membership to them based on their protocol types and encapsulation types. For example, after configuring the IPV4 protocol VLAN encapsulated by ehternet II, when receiving a packet of this kind without a VLAN tag, it will be classified as a member of the VLAN specified by IP protocol.

Protocol VLAN filter is only applied to the received packets without a VLAN tag. The packets with VLAN tags received on the same port will not be affected and will keep their

original state.

Protocol VLANs do not create new VLAN, but share with port-based VLANs. Once the packets enter these VLANs, they will be transmitted according to the same rules as port-based VLANs use.

Classified by network layer protocols, different protocols can belongs to different VLANs. This is very attractive for those networks hoping to organize users aiming at specific applications and services. Beside, users can move as they will within the network while keeping their VLAN membership unchanged. The advantage of this method is that, the physical location of users can change without reconfiguring the VLAN they belong to. And it is also very significant for the network managers that the VLAN can be classified by protocol type. What's more, this method does not need additional frame tag to identify VLANs, and thus can decrease the communication traffic of the network.

In DCS-3950 series, 1000bps network ports can support Protocol VLAN fucntion unconditionally, while the 100bps Ethernet ports have to be set to trunk ports to use the function.

9.4.2 Protocol VLAN Configuration Task List

1. Enable Protocol VLAN
2. Configure the protocol list entries

1. Enable Protocol VLAN

Command	Explanation
Global configuration mode	
protocol-vlan enable **no protocol-vlan enable**	Enable/disable Protocol VLAN

2. Configure the protocol list entries

Command	Explanation
Global configuration mode	
protocol-vlan mode {ethernetii etype <*etype-id*>|llc {dsap <*dasp-id*> ssap <*ssap-id*>}|snap etype <*etype-id*>} vlan <*vlan-id*> [priority <*priotiry-id*>] **no protocol-vlan {mode {ethernetii etype <*etype-id*>|llc {dsap <*dasp-id*> ssap <*ssap-id*>}|snap etype <*etype-id*>}|all}**	Add/delete the corresponding relationship between the protocol and VLAN, that is the specified protocol join/quilt the specified VLAN.

9.4.3 Protocol VLAN Command List

9.4.3.1 protocol-vlan enable

Command: protocol-vlan enable
no protocol-vlan enable
Function: Enable the protocol VLAN. If no is put in front of the command, the command will be disabled.
Command mode: Global Mode
Default: Protocol VLAN is disabled by default.
Usage Guide: Protocol VLAN should be enabled before executing the following commands.
Example: Enable the protocol VLAN. Switch #config
Switch (Config)#protocol-vlan enable

9.4.3.2 protocol-vlan mode

Command: protocol-vlan mode {ethernetii etype <*etype-id*>|llc {dsap <*dasp-id*> ssap <*ssap-id*>}|snap etype <*etype-id*>} vlan <*vlan-id*> [priority <*priority-id*>]
no protocol-vlan {mode {ethernetii etype <*etype-id*>|llc {dsap <*dasp-id*> ssap <*ssap-id*>}|snap etype <*etype-id*>}|all}
Function: Add the correspondence between the protocol and the VLAN namely specify the protocol to join specified VLAN. The 'no' form of this command deletes all or the correspondence
Parameters: Mode is the encapsulate type of the configuration which is ethernetii,llc andsnap;the encapsulate type of the ethernetii is EthernetII;etype-id is the type of the packet protocol, with a valid range of 1536~65535;llc is LLC encapsulate format;dasp-id is the access point of the destination service, the valid range is 0~255;aasp-id is the access point of the source service with a valid range of 0~255;snap is SNAP encapsulate format;etype-id is the type of the packet protocol, the valid range is 1536~65535;vlan-id is the ID of VLAN, the valid range is 1~4094;all indicates all the encapsulate protocols.
Command mode: Global Mode
Default: No protocol joined the VLAN by default
Usage Guide: This command is used to add specific protocols into the VLAN. If a packet of specified protocols without VLAN tags is received by the switch, it will be matched to the specified VLAN ID, and thus forwarded to that VLAN. The VLAN tag will be the same for those packets regardless from which port the packets are received. When this command is set, packets already attached with VLAN tags will not be affected. The ARP protocol is suggested to be configured if the IP protocol has been configured. Otherwise, some application may be influenced by the configuration.
Example: Assign the IP protocol data packet encapsulated by the EthernetII to VLAN200, QoS precedence is 0.
Switch #config
Switch (Config)#protocol-vlan enable
Switch (Config)#protocol-vlan mode ethernetii etype 2048 vlan 200 priority 0
Switch (Config)#protocol-vlan mode ethernetii etype 2054 vlan 200 priority 0

9.4.3.3 show protocol-vlan

Command: show portocol-vlan
Function: Display the configuration of Protocol-based VLAN on the switch
Parameter: None
Command mode: Admin Mode
Usage Guide: Display the configuration of the protocol based VLAN for the switch. Priority is the priority of the ports. When this value equals to ' ', this value will be determined by the ports default configuration.
Example: Show the configuration of the current protocol based VLANs.
Switch #show protocol-vlan

Encapsulation	Protocol	VLAN	Priority
EtherII	0x800	200	0
EtherII	0x806	200	0
SNAP	0x800	300	-

9.4.4 Protocol VLAN Troubleshooting

☞ Although there is no need, each IP protocol VLAN should contain an ARP protocol type, If not, the potential ARP failure might cause the diability to communicate

9.5 VLAN Troubleshooting

9.5.1 Monitor and Debug Command List

9.5.1.1 show vlan

Command: show vlan [brief|private-vlan] [id <*vlan-id*>] [name <vlan-name>] [summary]
Function: Display detailed information for all VLANs or specified VLAN.
Parameter: brief stands for brief information; **summary** for VLAN statistics; ***<vlan-id>*** for VLAN ID of the VLAN to display status information, the valid range is 1 to 4094; ***<vlan-name>*** is the VLAN name for the VLAN to display status information, valid length is 1 to 11 characters.
Command mode: Admin Mode
Usage Guide: If <vlan-id> or <vlan-name> is not specified, all information of the VLAN ports will be shown.
Example: Show status information for VLAN1.
Switch#show vlan id 1

```
VLAN Name        Type       Status    Ports
---- ------------ ----------  --------- ----------------------------------------
1      default        Static      Active    Ethernet0/0/1             Ethernet0/0/2
                                              Ethernet0/0/3             Ethernet0/0/4
                                              Ethernet0/0/5             Ethernet0/0/6
                                              Ethernet0/0/7             Ethernet0/0/8
                                              Ethernet0/0/9             Ethernet0/0/10
                                              Ethernet0/0/11           Ethernet0/0/12
                                              Ethernet0/0/13           Ethernet0/0/14
                                              Ethernet0/0/15           Ethernet0/0/16
                                              Ethernet0/0/17           Ethernet0/0/18
                                              Ethernet0/0/19           Ethernet0/0/20
                                              Ethernet0/0/21           Ethernet0/0/22
                                              Ethernet0/0/23           Ethernet0/0/24
```

Displayed information	Explanation
VLAN	VLAN number
Name	VLAN name
Type	VLAN type, statically configured or dynamically learned
Status	Active, Status of VLAN
Ports	Access port within a VLAN

Chapter 10 MSTP Configuration

10.1 Introduction to MSTP

The MSTP (Multiple STP) is a new spanning-tree protocol which is based on the STP and the RSTP. It runs on all the bridges of a bridged-LAN. It calculates a common and internal spanning tree (CIST) for the bridge-LAN which consists of the bridges running the MSTP, the RSTP and the STP. It also calculates the independent multiple spanning-tree instances (MSTI) for each MST domain (MSTP domain). The MSTP, which adopts the RSTP for its rapid convergence of the spanning tree, enables multiple VLANs to be mapped to the same spanning-tree instance which is independent to other spanning-tree instances. The MSTP provides multiple forwarding paths for data traffic and enables load balancing. Moreover, because multiple VLANs share a same MSTI, the MSTP can reduce the number of spanning-tree instances, which consumes less CPU resources and reduces the bandwidth consumption.

10.1.1 MSTP Region

Because multiple VLANs can be mapped to a single spanning tree instance, IEEE 802.1s committee raises the MST concept. The MST is used to make the association of a certain VLAN to a certain spanning tree instance.

A MSTP region is composed of one or multiple bridges with the same MCID (MST Configuration Identification) and the bridged-LAN (a certain bridge in the MSTP region is the designated bridge of the LAN, and the bridges attaching to the LAN are not running STP). All the bridges in the same MSTP region have the same MCID.

MSID consists of 3 attributes:

- Configuration Name: Composed by digits and letters
- Revision Level
- Configuration Digest: VLANs mapping to spanning tree instances

The bridges with the same 3 above attributes are considered as in the same MST region.

When the MSTP calculates CIST in a bridged-LAN, a MSTP region is considered as a bridge. See the figure below:

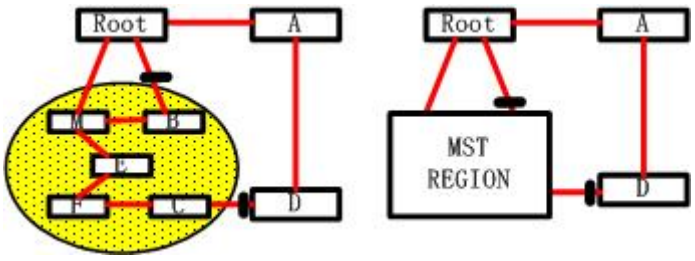


Fig 10-1 Understanding the CIST and MST Region

In the above network, if the bridges are running the STP other the RSTP, one port between Bridge M and Bridge B should be blocked. But if the bridges in the yellow range run the MSTP and are configured in the same MST region, MSTP will treat this region as a bridge. Therefore, one port between Bridge B and Root is blocked and one port on Bridge D is blocked.

10.1.1.1 Operations within the same MSTP Region

The IST connects all the MSTP bridges in a region. When the IST converges, the root of the IST becomes the IST master, which is the switch within the region with the lowest bridge ID and path cost to the CST root. The IST master also is the CST root if there is only one region within the network. If the CST root is outside the region, one of the MSTP bridges at the boundary of the region is scented as the IST master.

When a MSTP bridge initializes, it sends BPDUs claiming itself as the root of the CST and the IST master, with both of the path costs to the CST root and to the IST master set to zero. The bridge also initializes all of its MST instances and claims to be the root for all of them. If the bridge receives superior MST root information (lower bridge ID, lower path cost, and so forth) than currently stored for the port, it relinquishes its claim as the IST master.

Within a MST region, the IST is the only spanning-tree instance that sends and receives BPDUs. Because the MST BPDU carries information for all instances, the number of BPDUs that need to be processed by a switch to support multiple spanning-tree instances is significantly reduced.

All MST instances within the same region share the same protocol timers, but each MST instance has its own topology parameters, such as root switch ID, root path cost, and so forth.

10.1.1.2 Operations between MSTP Regions

If there are multiple regions or legacy 802.1D bridges within the network, MSTP establishes and maintains the CST, which includes all MST regions and all legacy STP bridges in the network. The MST instances combine with the IST at the boundary of the region to become the CST.

The MSTI is only valid within its MST region. An MSTI has nothing to do with MSTIs in other MST regions. The bridges in a MST region receive the MST BPDU of other regions through Boundary Ports. They only process CIST related information and abandon MSTI information.

10.1.2 Port Roles

The MSTP bridge assigns a port role to each port which runs MSTP.

- CIST port roles: root port, designated port, alternate port and backup port
- On top of those roles, each MSTI port has one new role: master port.

The port roles in the CIST (root port, designated port, alternate port and backup port) are defined in the same ways as those in the RSTP.

10.1.3 MSTP Load Balance

In a MSTP region, VLANs can be mapped to various instances. That can form various topologies. Each instance is independent from the others and each distance can has its own attributes such as bridge priority and port cost etc. Consequently, the VLANs in different instances have their own paths. The traffic of the VLANs are load-balanced.

10.2 MSTP Configuration

10.2.1 MSTP Configuration Task List

1. Enable the MSTP and set the running mode
2. Configure instance parameters
3. Configure MSTP region parameters
4. Configure MSTP time parameters
5. Configure the fast migrate feature for MSTP
6. Configure the format of port packet
7. Configure the snooping attribute of authentication key
8. Configure the FLUSH mode once topology changes

1. Enable MSTP and set the running mode

Command	Notes
Global Mode and Interface Mode	
spanning-tree **no spanning-tree**	Enable/Disable MSTP
Global Mode	
spanning-tree mode {mstp|stp} **no spanning-tree mode**	Set MSTP running mode
Interface Mode	
spanning-tree mcheck	Force port migration to run under MSTP

2. Configure instance parameters

Command	Notes
Global Mode	
spanning-tree mst <*instance-id*> **priority <*bridge-priority*>**	Set bridge priority for specified instance

no spanning-tree mst <*instance-id*> priority	
Interface Mode	
spanning-tree mst <*instance-id*> cost <*cost*> **no spanning-tree mst <*instance-id*> cost**	Set port path cost for specified instance
spanning-tree mst <*instance-id*> port-priority <*port-priority*> **no spanning-tree mst <*instance-id*> port-priority**	Set port priority for specified instance
spanning-tree mst <*instance-id*> *rootguard* **no spanning-tree mst <*instance-id*> *rootguard***	Set root guard for specified instance. Ports whose root guard option has been set, can not be converted to other types of root port.

3. Configure MSTP region parameters

Command	Notes
Global Mode	
spanning-tree mst configuration **no spanning-tree mst configuration**	Enter MSTP region mode. The ' **no spanning-tree mst configuration**' command restores the default setting.
MSTP region mode	
instance <*instance-id*> vlan <*vlan-list*> **no instance <*instance-id*> [vlan <*vlan-list*>]**	Create Instance and set mapping between VLAN and Instance
name <*name*> **no name**	Set MSTP region name
revision-level <*level*> **no revision-level**	Set MSTP region revision level
abort	Quit MSTP region mode and return to Global mode without saving MSTP region configuration
exit	Quit MSTP region mode and return to Global mode with saving MSTP region configuration

4. Configure MSTP time parameters

Command	Notes
Global Mode	
spanning-tree forward-time <*time*> **no spanning-tree forward-time**	Set the value for switch forward delay time
spanning-tree hello-time <*time*> **no spanning-tree hello-time**	Set the Hello time for sending BPDU messages

spanning-tree maxage <*time*> **no spanning-tree maxage**	Set Aging time for BPDU messages
spanning-tree max-hop <*hop-count*> **no spanning-tree max-hop**	Set Maximum number of hops of BPDU messages in the MSTP region

5. Configure the fast migrate feature for MSTP

Command	Notes
Global mode	
spanning-tree link-type p2p {auto|force-true|force-false} **no spanning-tree link-type**	Set the port link type
spanning-tree portfast default **spanning-tree portfast bpdufilter** **spanning-tree portfast bpduguard** **no spanning-tree portfast**	Set the port to be an boundary port. Bpdufilter is for dropping BPDU when it is received, bpduguard for close the port when receiving the BPDU. And no parameters means to convert to non-boundary

6. Configure the format of MSTP

Command	Notes
Interface Mode	
spanning-tree format standard **spanning-tree format privacy** **spanning-tree format auto** **no spanning-tree format**	Configure the format of port spanning-tree packet，standard format is provided by IEEE,privacy is compatible with CISCO and auto means the format is determinted by checking the received packet

7. Configure the snooping attribute of authentication key for MSTP

Command	Notes
Interface Mode	
spanning-tree digest-snooping **no spanning-tree digest-snooping**	Set the port to use the authentication string of partner port. **'no spanning-tree digest-snooping'** restores to use the generated string

8. Configure the FLUSH mode once topology changes for MSTP

Command	Notes
Global Mode	

spanning-tree tcflush enable **spanning-tree tcflush disable** **spanning-tree tcflush protect** **no spanning-tree tcflush**	Enable: the spanning-tree flush once the topology changes. Disable:the spanning tree don't flush when the topology changes. Protect: the spanning-tree flush every ten seconds **'no spanning-tree tcflush'** restores to default setting,enable flush once thetopology changes
端口配置模式	
spanning-tree tcflush enable **spanning-tree tcflush disable** **spanning-tree tcflush protect** **no spanning-tree tcflush**	Configure the port flush mode. **'no spanning-tree tcflush'** restores to use the global configured flush mode

10.2.2 MSTP Command List

10.2.2.1 abort

Command: abort

Function: Abort the current MSTP region configuration, quit MSTP region mode and return to global mode.

Command mode: MSTP region mode

Usage Guide: This command is to quit MSTP region mode without saving the current configuration. The previous MSTP region configuration is valid. This command is equal to 'Ctrl+z'.

Example: Quit MSTP region mode without saving the current configuration

Switch(Config-Mstp-Region)#abort

Switch(Config)#

10.2.2.2 exit

Command: exit

Function: Save current MSTP region configuration, quit MSTP region mode and return to global mode.

Command mode: MSTP region mode

Usage Guide: This command is to quit MSTP region mode with saving the current configuration.

Example: Quit MSTP region mode with saving the current configuration.

Switch(Config-Mstp-Region)#exit

Switch(Config)#

10.2.2.3 instance vlan

Command: instance <instance-id> vlan <vlan-list>
no instance <instance-id> [vlan <vlan-list>]

Function: In MSTP region mode, create the instance and set the mappings between VLANs and instances; the command '**no instance <*instance-id*> [vlan <*vlan-list*>]**' removes the specified instance and the specified mappings between the VLANs and instances.

Parameter: Normally, ***<instance-id>*** sets the instance number. The valid range is from 0 to 48; In the command '**no instance <*instance-id*> [vlan <*vlan-list*>]**', ***<instance-id>*** sets the instance number. The valid number is from 1 to 48. ***<vlan-list>*** sets consecutive or non-consecutive VLAN numbers. '-' refers to consecutive numbers, and ';' refers to non-consecutive numbers.

Command mode: MSTP region mode

Default: Before creating any Instances, there is only the instance 0, and VLAN 1~5094 all belong to the instance 0.

Usage Guide: This command sets the mappings between VLANs and instances. Only if all the mapping relationships and other attributes are same, the switches are considered in the same MSTP region. Before setting any instances, all the VLANs belong to the instance 0. MSTP can support maximum 48 MSTIs (except for CISTs). CIST can be treated as MSTI 0. All the other instances are considered as instance 1 to 48.

Example: Map VLAN1-10 and VLAN 100-110 to Instance 1.

Switch(Config)#spanning-tree mst configuration
Switch(Config-Mstp-Region)#instance 1 vlan 1-10;100-110

10.2.2.4 name

Command: name <name>
no name

Function: In MSTP region mode, set MSTP region name; The '**no name**' command restores the default setting.

Parameter: *<name>* is the MSTP region name. The length of the name should less than 32 characters.

Command mode: MSTP region mode

Default: Default MSTP region name is the MAC address of this bridge.

Usage Guide: This command is to set MSTP region name. The bridges with same MSTP region name and same other attributes are considered in the same MSTP region.

Example: Set MSTP region name to mstp-test.

Switch(Config)#spanning-tree mst configuration
Switch(Config-Mstp-Region)#name mstp-test

10.2.2.5 revision-level

Command: revision-level <level>

no revision-level

Function: In MSTP region mode, this command is to set revision level for MSTP configuration; the command '**no revision-level**' restores the default setting to 0.

Parameter: <*level*> is revision level. The valid range is from 0 to 65535.

Command mode: MSTP region mode

Default: The default revision level is 0.

Usage Guide: This command is to set revision level for MSTP configuration. The bridges with same MSTP revision level and same other attributes are considered in the same MSTP region.

Example: Set revision level to 2000.

Switch(Config)#spanning-tree mst configuration

Switch(Config-Mstp-Region)# revision-level 2000

10.2.2.6 spanning-tree

Command: spanning-tree

no spanning-tree

Function: Enable MSTP in global mode and in interface mode; The command '**no spanning-tree**' is to disable MSTP.

Command mode: Global Mode and Interface Mode

Default: MSTP is not enabled by default.

Usage Guide: If the MSTP is enabled in global mode, the MSTP is enabled in all the ports except for the ports which are set to disable the MSTP explicitly.

Example: Enable the MSTP in global mode, and disable the MSTP in the interface 0/0/2.

Switch(Config)#spanning-tree

Switch(Config)#interface ethernet 0/0/2

Switch(Config-Ethernet0/0/2)#no spanning-tree

10.2.2.7 spanning-tree forward-time

Command: spanning-tree forward-time <time>

no spanning-tree forward-time

Function: Set the switch forward delay time; The command '**no spanning-tree forward-time**' restores the default setting.

Parameter: <*time*> is forward delay time in seconds. The valid range is from 4 to 30.

Command mode: Global Mode

Default: The forward delay time is 15 seconds by default.

Usage Guide: When the network topology changes, the status of the port is changed from blocking to forwarding. This delay is called the forward delay. The forward delay is co working with hello time and max age. The parameters should meet the following conditions. Otherwise, the MSTP may work incorrectly.

2 * (Bridge_Forward_Delay - 1.0 seconds) >= Bridge_Max_Age

Bridge_Max_Age >= 2 * (Bridge_Hello_Time + 1.0 seconds)

Example: In global mode, set MSTP forward delay time to 20 seconds.

Switch(Config)#spanning-tree forward-time 20

10.2.2.8 spanning-tree hello-time

Command: spanning-tree hello-time <time>
no spanning-tree hello-time
Function: Set switch Hello time; The command '**no spanning-tree hello-time**' restores the default setting.
Parameter: <*time*> is Hello time in seconds. The valid range is from 1 to 10.
Command mode: Global Mode
Default: Hello Time is 2 seconds by default.
Usage Guide: Hello time is the interval that the switch sends BPDUs. Hello time is cooperating with forward delay and max age. The parameters should meet the following conditions. Otherwise, the MSTP may work incorrectly.
2 * (Bridge_Forward_Delay - 1.0 seconds) >= Bridge_Max_Age
Bridge_Max_Age >= 2 * (Bridge_Hello_Time + 1.0 seconds)
Example: Set MSTP hello time to 5 seconds in global mode.
Switch(Config)#spanning-tree hello-time 5

10.2.2.9 spanning-tree link-type p2p

Command: spanning-tree link-type p2p {auto|force-true|force-false}
no spanning-tree link-type
Function: Set the link type of the current port; The command '**no spanning-tree link-type**' restores link type to auto-negotiation.
Parameter: auto sets auto-negotiation, **force-true** forces the link as point-to-point type, **force-false** forces the link as non point-to-point type.
Command mode: Interface Mode
Default: The link type is auto by default, The MSTP detects the link type automatically.
Usage Guide: When the port is full-duplex, MSTP sets the port link type as point-to-point; When the port is half-duplex, MSTP sets the port link type as shared.
Example: Force the port 0/0/7-8 as point-to-point type.
Switch(Config)#interface ethernet 0/0/7-8
Switch(Config-Port-Range)#spanning-tree link-type p2p force-true

10.2.2.10 spanning-tree maxage

Command: spanning-tree maxage <time>
no spanning-tree maxage
Function: Set the max aging time for BPDU; The command '**no spanning-tree maxage**' restores the default setting.
Parameter: <*time*> is max aging time in seconds. The valid range is from 6 to 40.
Command mode: Global Mode
Default: The max age is 20 seconds by default.

Usage Guide: The lifetime of BPDU is called max age time. The max age is co working with hello time and forward delay. The parameters should meet the following conditions. Otherwise, the MSTP may work incorrectly.

2 * (Bridge_Forward_Delay - 1.0 seconds) >= Bridge_Max_Age

Bridge_Max_Age >= 2 * (Bridge_Hello_Time + 1.0 seconds)

Example: In global mode, set max age time to 25 seconds.

Switch(Config)#spanning-tree maxage 25

10.2.2.11 spanning-tree max-hop

Command: spanning-tree max-hop <hop-count>

no spanning-tree max-hop

Function: Set maximum hops of BPDU in the MSTP region; The command '**no spanning-tree max-hop**' restores the default setting.

Parameter: <*hop-count*> sets maximum hops. The valid range is from 1 to 40.

Command mode: Global Mode

Default: The max hop is 20 by default.

Usage Guide: The MSTP uses max-age to count BPDU lifetime. In addition, MSTP also uses max-hop to count BPDU lifetime. The max-hop is digressive in the network. The BPDU has the max value when it initiates from MSTI root bridge. Once the BPDU is received, the value of the max-hop is reduced by 1. When a port receives the BPDU with max-hop as 0, it drops this BPDU and sets itself as designated port to send the BPDU.

Example: Set max hop to 32.

Switch(Config)#spanning-tree max-hop 32

10.2.2.12 spanning-tree mcheck

Command: spanning-tree mcheck

Function: Force the port to run in the MSTP mode.

Command mode: Interface Mode

Default: The port is in the MSTP mode by default.

Usage Guide: If a network which is attached to the current port is running IEEE 802.1D STP, the port converts itself to run in STP mode. The command is used to force the port to run in the MSTP mode. But once the port receives STP messages, it changes to work in the STP mode again.

This command can only be used when the switch is running in IEEE802.1s MSTP mode. If the switch is running in IEEE802.1D STP mode, this command is invalid.

Example: Force the port 0/0/2 to run in the MSTP mode.

Switch(Config-Ethernet0/0/2)#spanning-tree mcheck

10.2.2.13 spanning-tree mode

Command: spanning-tree mode {mstp|stp}

no spanning-tree mode

Function: Set the spanning-tree mode in the switch; The command '**no spanning-tree mode**' restores the default setting.

Parameter: mstp sets the switch in IEEE802.1s MSTP mode; **stp** sets the switch in IEEE802.1D STP mode.

Command mode: Global Mode

Default: The switch is in the MSTP mode by default.

Usage Guide: When the switch is in IEEE802.1D STP mode, it only sends standard IEEE802.1D BPDU and TCN BPDU. It drops any MSTP BPDUs.

Example: Set the switch in the STP mode.

Switch(Config)#spanning-tree mode stp

10.2.2.14 spanning-tree mst configuration

Command: spanning-tree mst configuration

no spanning-tree mst configuration

Function: Enter the MSTP mode. Under the MSTP mode, the MSTP attributes can be set. The command '**no spanning-tree mst configuration**' restores the attributes of the MSTP to their default values.

Command mode: Global Mode

Default: The default values of the attributes of the MSTP region are listed as below:

MSTP Parameters	Default Values
Instance	There is only the instance 0. All the VLANs (1~4094) are mapped to the instance 0.
Name	MAC address of the bridge
Revision	0

Usage Guide: Whether the switch is in the MSTP region mode or not, users can enter the MSTP mode, configure the attributes, and save the configuration. When the switch is running in the MSTP mode, the system will generate the MST configuration identifier according to the MSTP configuration. Only the switches with the same MST configuration identifier are considered as in the same MSTP region.

Example: Enter MSTP region mode.

Switch(Config)#spanning-tree mst configuration

Switch(Config-Mstp-Region)#

10.2.2.15 spanning-tree mst cost

Command: spanning-tree mst <instance-id> cost <cost>

no spanning-tree mst <instance-id> cost

Function: Set path cost of the current port in the specified instance; The command '**no spanning-tree mst <instance-id> cost**' restores the default setting.

Parameter: <*instance-id*> sets the instance ID. The valid range is from 0 to 48. **<*cost*>** sets path cost. The valid range is from 1 to 200,000,000.

Command mode: Interface Mode

Default: By default, the port cost is relevant to the port bandwidth.

Port Type	Default Path Cost	Suggested Range
10Mbps	2000000	2000000~20000000
100Mbps	200000	200000~2000000
1Gbps	20000	20000~200000
10Gbps	2000	2000~20000

For the aggregation ports, the default costs are as below:

Port Type	Allowed Number Of Aggregation Ports	Default Port Cost
10Mbps	N	2000000/N
100Mbps	N	200000/N
1Gbps	N	20000/N
10Gbps	N	2000/N

Usage Guide: By setting the port cost, users can control the cost from the current port to the root bridge in order to control the elections of root port and the designated port of the instance.

Example: On the port 0/0/2, set the MSTP port cost in the instance 2 to 3000000.

Switch(Config-Ethernet0/0/2)#spanning-tree mst 2 cost 3000000

10.2.2.16 spanning-tree mst port-priority

Command: spanning-tree mst <instance-id> port-priority <port-priority>
no spanning-tree mst <instance-id> port-priority

Function: Set the current port priority for the specified instance; The command '**no spanning-tree mst *<instance-id>* port-priority**' restores the default setting.

Parameter: *<instance-id>* sets the instance ID. The valid range is from 0 to 48; ***<port-priority>*** sets port priority. The valid range is from 0 to 240. The value should be the multiples of 16, such as 0, 16, 32…240.

Command mode: Interface Mode

Default: The default port priority is 128.

Usage Guide: By setting the port priority, users can control the port ID of the instance in order to control the root port and designated port of the instance. The lower the value of the port priority is, the higher the priority is.

Example: Set the port priority as 32 on the port 0/0/2 for the instance 1.

Switch(Config)#interface ethernet 0/0/2

Switch(Config-Ethernet0/0/2)#spanning-tree mst 1 port-priority 32

10.2.2.17 spanning-tree mst priority

Command: spanning-tree mst <instance-id> priority <bridge-priority>
no spanning-tree mst <instance-id> priority

Function: Set the bridge priority for the specified instance; The command '**no spanning-tree mst <*instance-id*> priority**' restores the default setting.

Parameters: <*instance-id*> sets instance ID. The valid range is from 0 to 48; **<*bridge-priority*>** sets the switch priority. The valid range is from 0 to 61440. The value should be the multiples of 4096, such as 0, 4096, 8192…61440.

Command mode: Global Mode

Default: The default bridge priority is 32768.

Usage Guide: By setting the bridge priority, users can change the bridge ID for the specified instance. And the bridge ID can influence the elections of root bridge and designated port for the specified instance.

Example: Set the priority for Instance 2 to 4096.

Switch(Config)#spanning-tree mst 2 priority 4096

10.2.2.18 spanning-tree mst rootguard

Command: spanning-tree mst <*instance-id*> rootguard

no spanning-tree mst <*instance-id*> rootguard

Function: Enable the rootguard function for specified instance, the rootguard function forbid the port to be MSTP root port. 'no spanning-tree mst <instance-id> rootguard' disable the rootguard function.

Parameter:<*instance-id*>：MSTP instance ID.

Command mode: Interface Mode.

Default: Disable rootguard function.

Usage Guide: The command is used in interface mode ,if the port is configured to be a rootguand port , it is forbidden to be a MSTP root port. If superior BPDU packet is received from a rootguard port, MSTP did not recalculate spanning-tree, and just set the status of the port to be root_inconsistent(blocked).If no superior BPDU packet is received from a blocked rootguard port, the port status will restore to be forwarding. The rootguard function can maintain a relative stable spanning-tree topology when a new switch is added to the network.

Example: Enable rootguard function for port 0/0/2 in instance 0.

Switch(Config)#interface ethernet 0/0/2

Switch(Config-Ethernet-0/0/2)#spanning-tree mst 0 rootguard

10.2.2.19 spanning-tree portfast

Command: spanning-tree portfast

no spanning-tree portfast

Function: Set the current port as boundary port; The command 'no spanning-tree portfast' sets the current port as non-boundary port.

Parameters: **bpdufilter:** Set the boundary port mode as BPDU filter; **bpduguard:** Set the boundary port mode as BPDU guard; **default:** Set the boundary port mode as default.

Command mode: Interface Mode

Default: All the ports are non-boundary ports.

Usage Guide: When a port is set to be a boundary port, the port converts its status from discarding to forwarding without bearing forward delay. Once the boundary port receives the BPDU, the port becomes a non-boundary port.

Example: Set port 0/0/2 as boundary ports.

Switch(Config)#interface ethernet 0/0/2

Switch(Config-Ethernet-0/0/2)#spanning-tree portfast bpdufilter

Switch(Config-Ethernet-0/0/2)#

10.2.2.20 spanning-tree format

Command: spanning-tree format standard | privacy | auto

no spanning-tree format

Function: Configure the format of the port packet so to be interactive with products of other companies.

Parameters：

standard：The packet format provided by IEEE

privacy：Privacy packet format, which is compatible with CISCO equipments.

auto：Auto identified packet format, which is determined by checking the format of the received packets.

Default：Privacy Packet Format

Command mode：Port Mode

Usage Guide:

As the CISCO has adopted the packet format different with the one provided by IEEE, while many companies also adopted the CISCO format to be CISCO compatible, we have to provide support to both formats. The standard format is originally the one provided by IEEE, and the privacy packet format is CISCO compatible. In case we are not sure about which the packet format is on partner, the AUTO configuration will be preferred so to identify the format by the packets they sent. The privacy packet format is set by default in the concern of better compatibility with previous products and the leading companies. Also the packet format will be privacy format before receiving the partner packet when configured to AUTO.

When the format is not AUTO and the received packet format from the partner does not match the configured format, we set the state of the port which receives the unmatched packet to DISCARDING to prevent both sides consider themselves the root which leads to circuits.

When the AUTO format is set, and over one equipment which is not compatible with each other are connected on the port (e.g. a equipment running through a HUB or Transparent Transmission BPDU is connected with several equipments running MSTP), the format alter counts will be recorded and the port will be disabled at certain count threshold. The port can only be re-enabled by the administrator.

Example: Switch(config)#interface ethernet 0/0/2

Switch(Config)#interface ethernet 0/0/2

Switch(Config-Ethernet-0/0/2)#spanning-tree format standard

Switch(Config-Ethernet-0/0/2)#

10.2.2.21 spanning-tree digest-snooping

Command: spanning-tree digest-snooping
no spanning-tree digest-snooping
Function: Configure the port to use the authentication string of partner port .the command '**no spanning-tree digest-snooping**'restores to use the port generated authentication string.
Default: Don't use the authentication string of partner port .
Command mode: Interface Mode
Usage Guide:
According to MSTP protocol, the region authentication string is generated by MD5 algorithm with public authentication key, intstance ID, VLAN ID. Some manufactory don't use the public authentication key, this causes the incompatibility. After the command is executed the port can use the authentication string of partner port, realize compatibility with these manufactories equipment.
Notes: Because the authentication string is related to instance ID and VLAN ID, the command may cause recognizing the equipment that with different instance and VLAN relation as in the same region. Before the command is executed, make sure that instance and VLAN relation is accord for all the equipment. If there are more than one equipment connected , all the connected ports should execute this command.
Example:
Switch(Config)#interface ethernet 0/0/2
Switch(Config-Ethernet-0/0/2)#spanning-tree digest-snooping
Switch(Config-Ethernet-0/0/2)#

10.2.2.22 spanning-tree tcflush (global mode)

Command:spanning-tree tcflush enable
spanning-tree tcflush disable
spanning-tree tcflush protect
no spanning-tree tcflush
Function: Configure the spanning-tree flush mode once the topology changes. 'no spanning-tree tcflush' restores to default setting
Parameter:
Enable:the spanning-tree flush once the topology changes.
Disable:the spanning tree don't flush when the topology changes.
Protect: the spanning-tree flush every ten seconds
Default: enable。
Command mode: Global Mode。
Usage Guide:
According to MSTP, when topology changes, the port that send change message clears MAC/ARP table (FLUSH). In fact it is not needed for some network environment to do FLUSH with every topology change. At the same time ,as a method to avoid network assault, we allow the network administrator to configure FLUSH mode by the command

Note: For the complicated network, especially need to switch from one spanning tree branch to another rapidly, the disable mode is not recommended.

Example:

Switch(Config)#spanning-tree tcflush disable
Switch(Config)#

10.2.2.23 spanning-tree tcflush (port mode)

Command: spanning-tree tcflush {enable| disable| protect}
no spanning-tree tcflush

Function: Configure the spanning-tree flush mode for port once the topology changes . 'no spanning-tree tcflush' restores to default setting

Parameter:

Enable:the spanning-tree flush once the topology changes.
Disable:the spanning tree don't flush when the topology changes.
Protect: the spanning-tree flush every ten seconds

Default: Global configuration

Command mode: Interface Mode

Usage Guide:

According to MSTP, when topology changes, the port that send change message clears MAC/ARP table (FLUSH). In fact it is not needed for some network environment to do FLUSH with every topology change. At the same time ,as a method to avoid network assault, we allow the network administrator to configure FLUSH mode by the command

Notes: For the complicated network, especially need to switch from one spanning tree branch to another rapidly, the disable mode is not recommended.

Example:

Switch(Config)#interface ethernet 0/0/2
Switch(Config-Ethernet-0/0/2)#spanning-tree tcflush disable
Switch(Config-Ethernet-0/0/2)#

10.3 MSTP Configuration Example

The following is a typical MSTP application scenario:

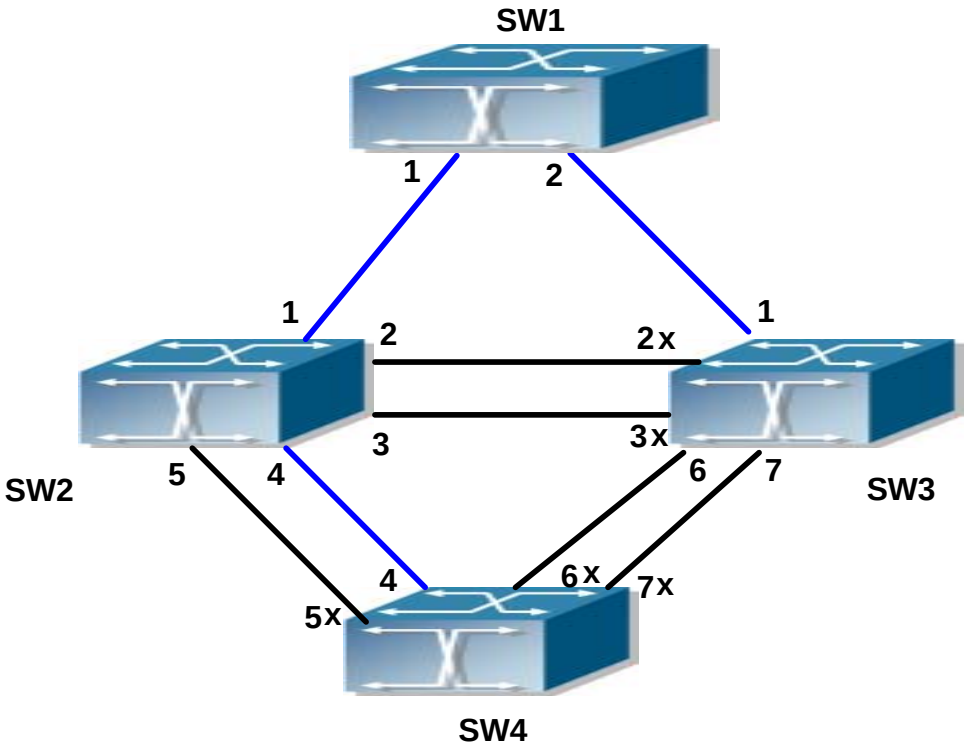


Figure 10-2 Typical MSTP Application Scenario

The connections among the switches are shown in the above figure. All the switches run in the MSTP mode by default, their bridge priority, port priority and port route cost are all in the default values (equal). The default configuration for switches is listed below:

Bridge Name		SW1	SW2	SW3	SW4
Bridge MAC Address		…00-00-01	…00-00-02	…00-00-03	…00-00-04
Bridge Priority		32768	32768	32768	32768
Port Priority	Port 1	128	128	128	
	Port 2	128	128	128	
	Port 3		128	128	
	Port 4		128		128
	Port 5		128		128
	Port 6			128	128
	Port 7			128	128
Route Cost	Port 1	200000	200000	200000	
	Port 2	200000	200000	200000	
	Port 3		200000	200000	
	Port 4		200000		200000
	Port 5		200000		200000
	Port 6			200000	200000
	Port 7			200000	200000

By default, the MSTP establishes a tree topology (in blue lines) rooted with SwitchA. The ports marked with ‘x’ are in the discarding status, and the other ports are in the forwarding status.

Configurations Steps:

Step 1: Configure port to VLAN mapping:

- Create VLAN 20, 30, 40, 50 in SW2, SW3 and SW4.
- Set ports 1-7 as trunk ports in SW2, SW3 and SW4.

Step 2: Set SW2, SW3 and SW4 in the same MSTP:

- Set SW2, SW3 and SW4 to have the same region name as mstp.
- Map VLAN 20 and VLAN 30 in SW2, SW3 and SW4 to Instance 3; Map VLAN 40 and VLAN 50 in SW2, SW3 and SwitchD to Instance 4.

Step 3: Set SW3 as the root bridge of Instance 3; Set SW4 as the root bridge of Instance 4

- Set the bridge priority of Instance 3 in SW3 as 0.
- Set the bridge priority of Instance 4 in SW4 as 0.

The detailed configuration is listed below:

On SW2:

```
SW2(Config)#vlan 20
SW2(Config-Vlan20)#exit
SW2(Config)#vlan 30
SW2(Config-Vlan30)#exit
SW2(Config)#vlan 40
SW2(Config-Vlan40)#exit
SW2(Config)#vlan 50
SW2(Config-Vlan50)#exit
SW2(Config)#spanning-tree mst configuration
SW2(Config-Mstp-Region)#name mstp
SW2(Config-Mstp-Region)#instance 3 vlan 20;30
SW2(Config-Mstp-Region)#instance 4 vlan 40;50
SW2(Config-Mstp-Region)#exit
SW2(Config)#interface e 0/0/1-7
SW2(Config-Port-Range)#switchport mode trunk
SW2(Config-Port-Range)#exit
SW2(Config)#spanning-tree
```

On SW3:

```
SW3(Config)#vlan 20
SW3(Config-Vlan20)#exit
SW3(Config)#vlan 30
SW3(Config-Vlan30)#exit
```

```
SW3(Config)#vlan 40
SW3(Config-Vlan40)#exit
SW3(Config)#vlan 50
SW3(Config-Vlan50)#exit
SW3(Config)#spanning-tree mst configuration
SW3(Config-Mstp-Region)#name mstp
SW3(Config-Mstp-Region)#instance 3 vlan 20;30
SW3(Config-Mstp-Region)#instance 4 vlan 40;50
SW3(Config-Mstp-Region)#exit
SW3(Config)#interface e 0/0/1-7
SW3(Config-Port-Range)#switchport mode trunk
SW3(Config-Port-Range)#exit
SW3(Config)#spanning-tree
SW3(Config)#spanning-tree mst 3 priority 0
```

On SW4:

```
SW4(Config)#vlan 20
SW4(Config-Vlan20)#exit
SW4(Config)#vlan 30
SW4(Config-Vlan30)#exit
SW4(Config)#vlan 40
SW4(Config-Vlan40)#exit
SW4(Config)#vlan 50
SW4(Config-Vlan50)#exit
SW4(Config)#spanning-tree mst configuration
SW4(Config-Mstp-Region)#name mstp
SW4(Config-Mstp-Region)#instance 3 vlan 20;30
SW4(Config-Mstp-Region)#instance 4 vlan 40;50
SW4(Config-Mstp-Region)#exit
SW4(Config)#interface e 0/0/1-7
SW4(Config-Port-Range)#switchport mode trunk
SW4(Config-Port-Range)#exit
SW4(Config)#spanning-tree
SW4(Config)#spanning-tree mst 4 priority 0
```

After the above configuration, SW1 is the root bridge of the instance 0 of the entire network. In the MSTP region which SW2, SW3 and SW4 belong to, SW2 is the region root of the instance 0, SW3 is the region root of the instance 3 and SW4 is the region root of the instance 4. The traffic of VLAN 20 and VLAN 30 is sent through the topology of the instance 3. The traffic of VLAN 40 and VLAN 50 is sent through the topology of the instance 4. And the traffic of other VLANs is sent through the topology of the instance 0. The port 1 in SW2 is the master port of the instance 3 and the instance 4.

The MSTP calculation generates 3 topologies: the instance 0, the instance 3 and the instance 4 (marked with blue lines). The ports with the mark ‘x’ are in the status of

discarding. The other ports are the status of forwarding. Because the instance 3 and the instance 4 are only valid in the MSTP region, the following figure only shows the topology of the MSTP region.

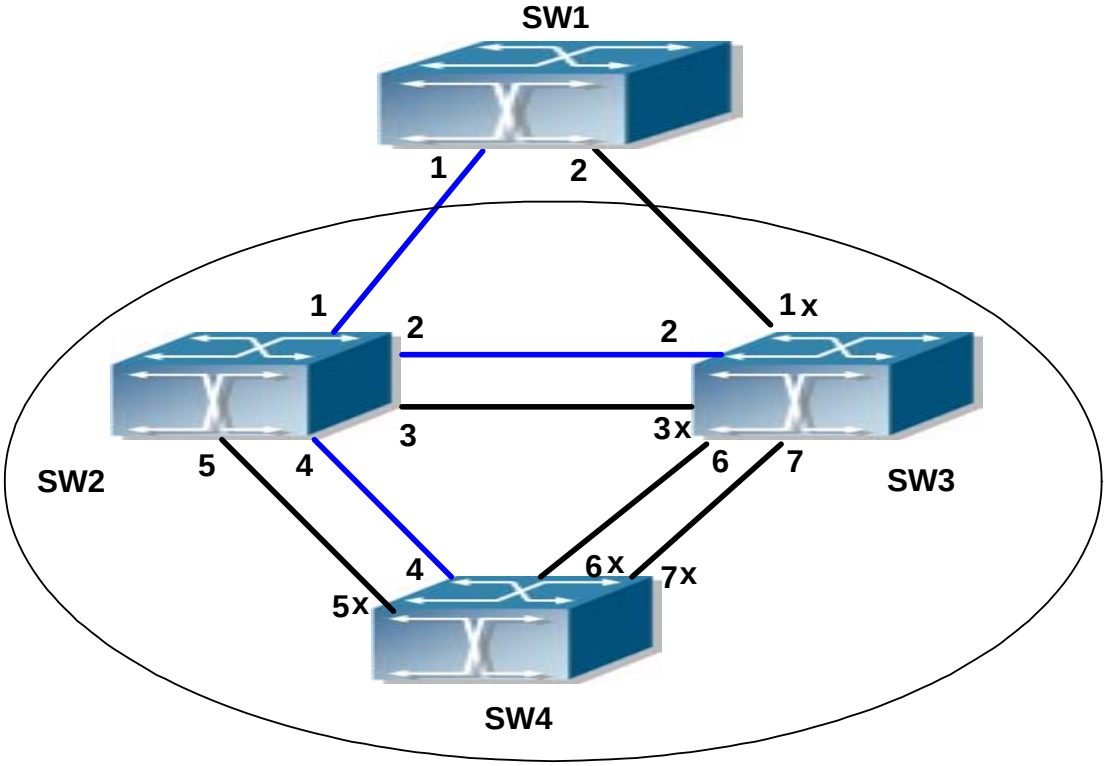


Figure 10-3 The Topology Of the Instance 0 after the MSTP Calculation

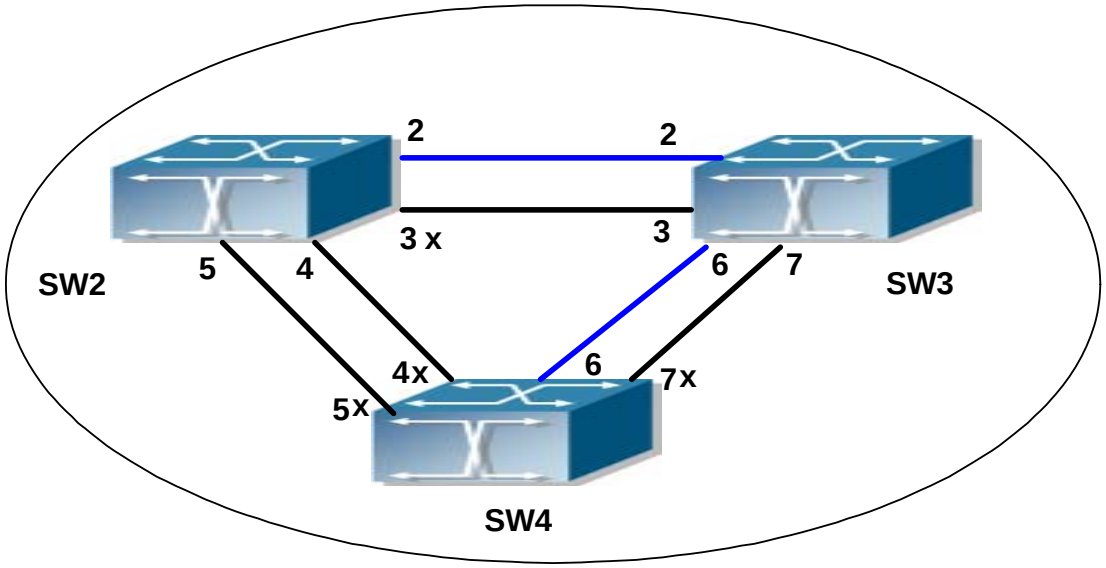


Figure 10-4 The Topology Of the Instance 3 after the MSTP Calculation

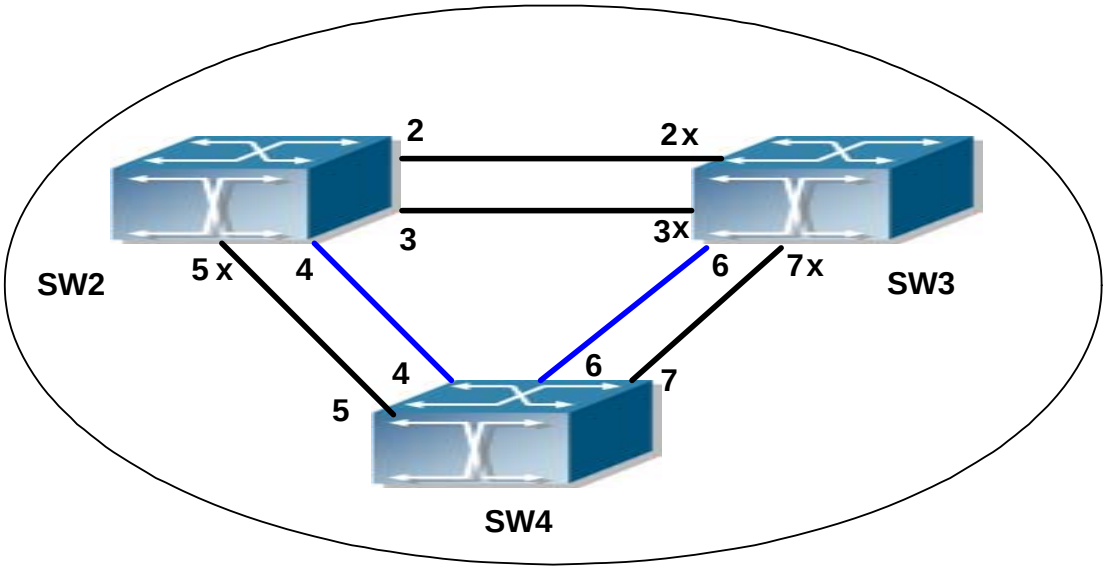


Figure 10-5 The Topology Of the Instance 4 after the MSTP Calculation

10.4 MSTP Troubleshooting

10.4.1 Monitor and Debug Command List

10.4.1.1 show spanning-tree

Command: show spanning-tree [mst [<*instance-id*>]] [interface <*interface-list*>] [detail]
Function: Display the MSTP Information.
Parameter: <*instance-id*> sets the instance ID. The valid range is from 0 to 48; **<*interface-list*>** sets interface list; **detail** sets the detailed spanning-tree information.
Command mode: Admin Mode
Usage Guide: This command can display the MSTP information of the instances in the current bridge.
Example: Display the information of bridge MSTP as below tables:
Switch#sh spanning-tree

-- MSTP Bridge Config Info --

Standard : IEEE 802.1s
Bridge MAC : 00:03:0f:01:0e:30
Bridge Times : Max Age 20, Hello Time 2, Forward Delay 15
Force Version: 3

```
############################## Instance 0 ##############################
Self Bridge Id     : 32768 -    00:03:0f:01:0e:30
Root Id                : 16384.00:03:0f:01:0f:52
Ext.RootPathCost : 200000
Region Root Id     : this switch
Int.RootPathCost : 0
Root Port ID        : 128.1
Current port list in Instance 0:
Ethernet0/0/1 Ethernet0/0/2 (Total 2)
PortName         ID         ExtRPC     IntRPC    State Role        DsgBridge        DsgPort
-------------- ------- --------- --------- --- ---- ------------------ -------
  Ethernet0/0/1    128.001              0           0 FWD ROOT 16384.00030f010f52 128.007
  Ethernet0/0/2    128.002              0             0 BLK ALTR 16384.00030f010f52 128.011

############################## Instance 3 ##############################
Self Bridge Id     : 0.00:03:0f:01:0e:30
Region Root Id     : this switch
Int.RootPathCost : 0
Root Port ID       : 0
Current port list in Instance 3:
Ethernet0/0/1 Ethernet0/0/2 (Total 2)

PortName         ID       IntRPC     State Role        DsgBridge        DsgPort
-------------- ------- --------- --- ---- ------------------ -------
  Ethernet0/0/1    128.001              0 FWD MSTR        0.00030f010e30 128.001
  Ethernet0/0/2    128.002              0 BLK ALTR        0.00030f010e30 128.002

############################## Instance 4 ##############################
Self Bridge Id     : 32768.00:03:0f:01:0e:30
Region Root Id     : this switch
Int.RootPathCost : 0
Root Port ID       : 0
Current port list in Instance 4:
Ethernet0/0/1 Ethernet0/0/2 (Total 2)

PortName         ID       IntRPC     State Role        DsgBridge        DsgPort
-------------- ------- --------- --- ---- ------------------ -------
  Ethernet0/0/1 128.001               0 FWD MSTR 32768.00030f010e30 128.001
  Ethernet0/0/2128.002               0 BLK ALTR 32768.00030f010e30 128.002
```

Displayed Items	Notes
Bridge Information	
Standard	STP version

Bridge MAC	Bridge MAC address
Bridge Times	Max Age, Hello Time and Forward Delay of the bridge
Force Version	Version of STP
Instance Information	
Self Bridge Id	The priority and the MAC address of the current bridge for the current instance
Root Id	The priority and the MAC address of the root bridge for the current instance
Ext.RootPathCost	Total cost from the current bridge to the root of the entire network
Int.RootPathCost	Cost from the current bridge to the region root of the current instance
Root Port ID	Root port of the current instance on the current bridge
MSTP Port List Of The Current Instance	
PortName	Port name
ID	Port priority and port index
ExtRPC	Port cost to the root of the entire network
IntRPC	Cost from the current port to the region root of the current instance
State	Port status of the current instance
Role	Port role of the current instance
DsgBridge	Upward designated bridge of the current port in the current instance
DsgPort	Upward designated port of the current port in the current instance

10.4.1.2 show spanning-tree mst config

Command: show spanning-tree mst config

Function: Display the configuration of the MSTP in the Admin mode.

Command mode: Admin Mode

Usage Guide: In the Admin mode, this command can show the parameters of the MSTP configuration such as MSTP name, revision, VLAN and instance mapping.

Example: Display the configuration of the MSTP on the switch.

```
Switch#show spanning-tree mst config

Name      digitalChina
Revision  0
Instance  Vlans Mapped
---------------------------------
00        1-29, 31-39, 41-4094
```

03 30
04 40

10.4.1.3 show mst-pending

Command: show mst-pending
Function: In the MSTP region mode, display the configuration of the current MSTP region.
Command mode: MSTP region mode
Usage Guide: In the MSTP region mode, display the configuration of the current MSTP region such as MSTP name, revision, VLAN and instance mapping.
Note: Before quitting the MSTP region mode, the displayed parameters may not be effective.
Example: Display the configuration of the current MSTP region.

```
Switch(Config)#spanning-tree mst configuration
Switch(Config-Mstp-Region)#show mst-pending
Name          digitalChina
Revision      0
Instance      Vlans Mapped
---------------------------------
00            1-29, 31-39, 41-4093
03            30
04            40
05            4094
---------------------------------
Switch(Config-Mstp-Region)#
```

10.4.1.4 debug spanning-tree

Command: debug spanning-tree
no debug spanning-tree
Function: Enable the MSTP debugging information; The command '**no debug spanning-tree**' disables the MSTP debugging information
Command mode: Admin Mode
Usage Guide: This command is the general switch for all the MSTP debugging. Users should enable the detailed debugging information, then they can use this command to display the relevant debugging information. In general, this command is used by skilled technicians.
Example: Enable to receive the debugging information of BPDU messages on the port 0/0/1

```
Switch#debug spanning-tree
Switch#debug spanning-tree bpdu rx interface ethernet 0/0/1
```

10.4.2 MSTP Troubleshooting

- In order to run the MSTP on the switch port, the MSTP has to be enabled globally. If the MSTP is not enabled globally, it can't be enabled on the port.
- The MSTP parameters co work with each other, so the parameters should meet the following conditions. Otherwise, the MSTP may work incorrectly.
  2×(Bridge_Forward_Delay -1.0 seconds) >= Bridge_Max_Age
  Bridge_Max_Age >= 2 ×(Bridge_Hello_Time + 1.0 seconds)
- When users modify the MSTP parameters, they have to be sure about the changes of the topologies. The global configuration is based on the bridge. Other configurations are based on the individual instances.
- The MSTP are mutually exclusive with MAC binding and IEEE 802.1x on the switch port. If MAC binding or IEEE 802.1x is enabled on the port, the MSTP can't apply to this port.

Chapter 11 IGMP Snooping

11.1 Introduction to IGMP Snooping

IGMP (Internet Group Management Protocol) is a protocol used in IP multicast. IGMP is used by multicast enabled network device (such as a router) for host membership query, and by hosts that are joining a multicast group to inform the router to accept packets of a certain multicast address. All those operations are done through IGMP message exchange. The router will use a multicast address (224.0.0.1) that can address to all hosts to send a IGMP host membership query message. If a host wants to join a multicast group, it will reply to the multicast address of that a multicast group with a IGMP host membership reports a message.

IGMP Snooping is also referred to as IGMP listening. The switch prevents multicast traffic from flooding through IGMP Snooping, multicast traffic is forwarded to ports associated to multicast devices only. The switch listens to the IGMP messages between the multicast router and hosts, and maintains multicast group forwarding table based on the listening result, and can then decide to forward multicast packets according to the forwarding table.

DCS-3950 series switch provides IGMP Snooping and is able to send a query from the switch so that the user can use DCS-3950 series switch in IP multicast.

11.2 IGMP Snooping Configuration

11.2.1 IGMP Snooping Configuration Task List

1. Enable IGMP Snooping
2. Configure IGMP Snooping

1. Start IGMP Snooping function

Command	Explanation
Global configuration mode	
Ip igmp snooping **No ip igmp snooping**	Start IGMP Snooping function; the ‘ No ip igmp snooping’ command will shut down the IGMP snooping function globally.

2. Configure IGMP Snooping

Command	Explanation
Global configuration mode	
Ip igmp snooping vlan <*vlan-id*> **No ip igmp snooping vlan <*vlan-id*>**	Start IGMP Snooping function on the specified vlan.’ No ip igmp snooping vlan

	<vlan-id> ‘command will disalbe IGMP function on the sepcified vlan.
Ip igmp snooping vlan < *vlan-id* > limit {group <*g_limit*> | source <*s_limit*>} **No ip igmp snooping vlan < *vlan-id* > limit**	Set the max number of the groups IGMP snooping can join and the max number of sources each group can have.’ No ip igmp snooping vlan < vlan-id > limit ‘ will reset it to default value.
Ip igmp snooping vlan <*vlan-id*> l2-general-querier **No ip igmp snooping vlan <*vlan-id*> l2-general-querier**	Set this vlan to a layer 2 general queirer. It is recommended that each segment should configure a layer 2 general queirer.’ No ip igmp snooping vlan <vlan-id> l2-general-querier’ command will cancel the configuration of layer 2 general queirer
Ip igmp snooping vlan <*vlan-id*> mrouter-port interface <*interface –name*> **No ip igmp snooping vlan <*vlan-id*> mrouter-port interface <*interface –name*>**	Set the static mrouter por.’ No ip igmp snooping vlan <vlan-id> mrouter-port interface <interface –name>‘command will cancel the configuration of mrouter port.
Ip igmp snooping vlan <*vlan-id*> mrpt < *value* > **No ip igmp snooping vlan <*vlan-id*> mrpt**	Set the keep-alive time of the mrouter port, the’ No ip igmp snooping vlan <vlan-id> mrpt’ command will reset it to default value
Ip igmp snooping vlan <*vlan-id*> query-interval <*value*> **No ip igmp snooping vlan <*vlan-id*> query-interval**	Set the query interval, ‘No ip igmp snooping vlan <vlan-id> query-interval ‘ command will reset it to default value.
Ip igmp snooping vlan <*vlan-id*> immediate-leave **No ip igmp snooping vlan <*vlan-id*> immediate-leave**	Set the IGMP snooping of specified vlan to enable the immediate-leave function;’ No ip igmp snooping vlan <vlan-id> immediate-leave’command will cancel immediate-leave configuraiton.
Ip igmp snooping vlan <*vlan-id*> query-mrsp <*value*> **No ip igmp snooping vlan <*vlan-id*> query-mrsp**	Set the max query response time,’ No ip igmp snooping vlan <vlan-id> query-mrsp’ command command will reset it to default value.
Ip igmp snooping vlan <vlan-id> query-robustness <*value*> **No ip igmp snooping vlan <vlan-id> query-robustness**	Set the robustness, ‘No ip igmp snooping vlan <vlan-id> query-robustness’ will reset it to default value.
Ip igmp snooping vlan <*vlan-id*> suppression-query-time <*value*> **No ip igmp snooping vlan <*vlan-id*> suppression-query-time**	Set the suppression time of query; ‘No ip igmp snooping vlan <vlan-id> suppression-query-time’ will reset it to default value.
ip igmp snooping vlan <*vlan-id*>	Set the statci group of the specified port,

tatic-group <multicast-IPAddress> interface {[ethernet|port-channel] <interfaceName> **No ip igmp snooping vlan <*vlan-id*> tatic-group <multicast-IPAddress> interface {[ethernet|port-channel] <interfaceName>**	the 'No ip igmp snooping vlan <vlan-id> tatic-group <multicast-IPAddress> interface {[ethernet|port-channel] <interfaceName> command will cancel the configuration.

11.2.2 IGMP Snooping configuration Command List

11.2.2.1 ip igmp snooping

Command: ip igmp snooping
no ip igmp snooping
Function: Enable the IGMP Snooping function: the ' **no ip igmp snooping'** command disables this function**.**
Command mode: Global Mode
Default: IGMP Snooping is disabled by default.
Usage Guide: Use this command to enable IGMP Snooping, that is permission every vlan config the function of IGMP snooping. the ' **no ip igmp snooping'** command disables this function**.**
Example: Enable IGMP Snooping.
Switch (Config)#ip igmp snooping

11.2.2.2 ip igmp snooping vlan

Command: ip igmp snooping vlan <vlan-id>
no ip igmp snooping vlan <vlan-id>
Function: Enable the IGMP Snooping function for the specified VLAN: the '**no ip igmp snooping vlan <vlan-id>**'command disables the IGMP Snooping function for the specified VLAN.
Parameter: <*vlan-id*> is the VLAN number.
Command mode: Global Mode
Default: IGMP Snooping is disabled by default.
Usage Guide: To configure IGMP Snooping on specified vlan, the global IGMP Snooping should be first enabled. Disable IGMP Snooping on specified vlan with the 'no ip igmp snooping vlan <vlan-id>' command.
Example: Enable IGMP Snooping for VLAN 100 in Global Mode.
Switch (Config)#ip igmp snooping vlan 100

11.2.2.3 ip igmp snooping vlan immediate-leave

Command: ip igmp snooping vlan <vlan-id> immediate-leave
no ip igmp snooping vlan <vlan-id> immediate-leave
Function: Enable the IGMP fast leave function for the specified VLAN: the '**no ip igmp snooping vlan <vlan-id> immediate-leave**' command disables the IGMP fast leave function.
Parameter: <*vlan-id*> is the VLAN number specified, ranging between <1-4094>.
Command mode: Global Mode
Default: This function is disabled by default.
Usage Guide: Enable immediate-leave function of the IGMP Snooping in specified vlan; the'no' form of this command disables the immediate-leave function of the IGMP Snooping.
Example: Enable the IGMP fast leave function for VLAN 100.
Switch (Config)#ip igmp snooping vlan 100 immediate-leave

11.2.2.4 ip igmp snooping vlan l2-general-querier

Command: ip igmp snooping vlan < vlan-id > l2-general-querier
no ip igmp snooping vlan < vlan-id > l2-general-querier
Function: Set this vlan to layer 2 general querier
Parameter: ***vlan-id***: is ID number of the VLAN, ranging between <1-4094>
Command mode: Global Mode
Default: vlan is not as the IGMP Snooping layer 2 general querier
Usage Guide:
It is recommended to configure a layer 2 general querier on a segment. IGMP Snooping function will be enabled by this command if not enabled on this vlan before configuring this command, IGMP Snooping function will not be disabled when disabling the layer 2 general querier function. This command is mainly for sending general queries regularly to help switches within this segment learn mrouter ports.
Comment: There are three paths igmp snooping learns mrouter
1 Port receives the IGMP query messages
2 Port receives multicast protocol packets, and supports DVMRP, PIM.
3 Static configured port

11.2.2.5 ip igmp snooping vlan limit

Command: ip igmp snooping vlan <vlan-id>
no ip igmp snooping vlan <vlan-id>
Function: Enable the IGMP Snooping function for the specified VLAN: the '**no ip igmp snooping vlan <vlan-id>**'command disables the IGMP Snooping function for the specified VLAN.
Parameters: <*vlan-id*> is the VLAN number, ranging between <1-4094>; **<*g_limit*>** is the max number of joined group,ranging between<1-65535>;**<*s_limit*>** is the max number of specified VLAN in a group,both include and exclude resource are involved,ranging between<1-65535>.

Command mode: Global Mode

Default: IGMP Snooping is disabled by default.

Usage Guide: When number of joined group reaches the limit, new group requesting for joining in will be rejected for preventing hostile attacks. To use this command, IGMP snooping must be enabled on vlan. The 'no' form of this command restores the default other than set to 'no limit'. For the safety considerations, this command will not be configured to 'no limit'. It is recommended to use default value and if layer 3 IGMP is in operation, please make this configuration in accordance with the IGMP configuration as possible.

Example:

Switch(config)#ip igmp snooping vlan 2 limit group 300

11.2.2.6 ip igmp snooping vlan mrouter-port interface

Command: ip igmp snooping vlan <*vlan-id*> mrouter-port interface (<*ehternet*>|<*ifname*>|<*port-channel*>)

no ip igmp snooping vlan <*vlan-id*> mrouter-port interface (<*ehternet*>|<*ifname*>|<*port-channel*>)

Function: Configure static mrouter port of vlan. The '**no ip igmp snooping vlan <*vlan-id*> mrouter-port interface (<*ehternet*>|<*ifname*>|<*port-channel*>)**' command cancels this configuration

Parameters: ***vlan-id***: ranging between <1-4094>

ehternet: Name of Ethernet port

ifname: Name of interface

***port-channel*: Port aggregation**

Command mode: Global Mode

Default: No static mrouter port on vlan by default.

Usage Guide: When a port is a static mrouter port while also a dynamic mrouter port, it should be taken as a static mrouter port. Deleting static mrouter port can only be realized by the '**no ip igmp snooping vlan <*vlan-id*> mrouter-port interface [<*ehternet*>|<*port-channel*>]<*ifname*>**' command.

Example:

Switch(config)#ip igmp snooping vlan 2 mrouter-port interface ethernet0/0/13

11.2.2.7 ip igmp snooping vlan mrpt

Command: ip igmp snooping vlan <vlan-id> mrpt <value>

no ip igmp snooping vlan <vlan-id> mrpt

Function: Configure this survive time of mrouter port

Parameters: ***vlan-id***: vlan id , ranging between <1-4094>

value: mrouter port survive period, ranging between <1-65535>seconds

Command mode: Global Mode

Default: 255s

Usage Guide: This command validates on dynamic mrouter ports but not on mrouter port.

To use this command, IGMP Snooping of this vlan should be enabled previously.

Example: Switch(config)#ip igmp snooping vlan 2 mrpt 100

Switch(config)#ip igmp snooping vlan 2 mrpt 100

11.2.2.8 ip igmp snooping vlan query-interval

Command: ip igmp snooping vlan <vlan-id> query-interval <value>

no ip igmp snooping vlan <vlan-id> query-interval

Function: Configure this query interval

Parameters: ***vlan-id***: vlan id , ranging between <1-4094>

value: query interval, ranging between <1-65535>seconds

Command mode: Global Mode

Default: 125s

Usage Guide: It is recommended to use the default settings. Please keep this configure in accordance with IGMP configuration as possible.

Example:

Switch(config)#ip igmp snooping vlan 2 query-interval 130

11.2.2.9 ip igmp snooping vlan query-mrsp

Command: ip igmp snooping vlan <vlan-id> query-mrsp <value>

no ip igmp snooping vlan <vlan-id> query-mrsp

Function: Configure the maximum query response period. The '**no ip igmp snooping vlan <*vlan-id*> query-mrsp**' command restores to the default value

Parameters: ***vlan-id***: vlan id , ranging between <1-4094>

value: query interval, ranging between <10-25> seconds

Command mode: Global Mode

Default: 10s

Usage Guide: It is recommended to use the default settings. Please keep this configure in accordance with IGMP configuration as possible.

Example: Switch(config)#ip igmp snooping vlan 2 query-mrsp 18

11.2.2.10 ip igmp snooping vlan query-robustness

Command: ip igmp snooping vlan <vlan-id> query-robustness <value>

no ip igmp snooping vlan <vlan-id> query-robustness

Function: Configure the query robustness. The '**no ip igmp snooping vlan <vlan-id> query-robustness**' command restores to the default value

Parameters: ***vlan-id***: vlan id , ranging between <1-4094>

value: query interval, ranging between <2-10> seconds

Command mode: Global Mode

Default: query interval is 2

Usage Guide: It is recommended to use the default settings. Please keep this configure in accordance with IGMP configuration as possible.

Example: Switch(config)#ip igmp snooping vlan 2 query- robustness 3

11.2.2.11 ip igmp snooping vlan suppression-query-time

Command: ip igmp snooping vlan <vlan-id> suppression-query-time <value>
no ip igmp snooping vlan <vlan-id> suppression-query-time
Function: Configure the suppression query time. The '**no ip igmp snooping vlan <*vlan-id*> suppression-query-time**' command restores to the default value
Parameters: ***vlan-id***: vlan id , ranging between <1-4094>
value: query interval, ranging between<1-65535> seconds
Command mode: Global Mode
Default: 255s
Usage Guide: This command can only be configured on L2 general querier. The Suppression-query-time refers to the period of suppression state in which the querier enters when receives query from the layer 3 IGMP in the segments.
Example: Switch(config)#ip igmp snooping vlan 2 suppression-query-time 270

11.2.2.12 ip igmp snooping vlan static-group

Command: ip igmp snooping vlan <*vlanid*> static-group <*multicast-IPAddress*>
interface {[ethernet|port-channel] <*interfaceName*>}
no ip igmp snooping vlan <*vlanid*> static-group <*multicast-IPAddress*>
interface {[ethernet|port-channel] <*interfaceName*>}
Function：Configure static-group on specified port of the vlan. The no form of thecommand cancels this configuration.
Parameters: <*vlan-id*> is the id number for the VLAN，with its value limited to 1-4094；***<multicast-ip-addr>*** is the multicast IP address；***<interface-name>*** is the interface which is the member of the multicasting group.
Default: No configuration static group by default.
Usage Guide: When a group is a static while also a dynamic group, it should be taken as a static group. Deleting static group can only be realized by the no form of the command.
Example: Configure a static multicast IP address as 224.1.1.1 for VLAN 100. And add ethernet 0/0/6 to the group.
Switch(Config)#no ip igmp snooping vlan 100 static- group 224.1.1.1 interface eth0/0/6

11.3 IGMP Snooping Example

Scenario 1：IGMP Snooping function

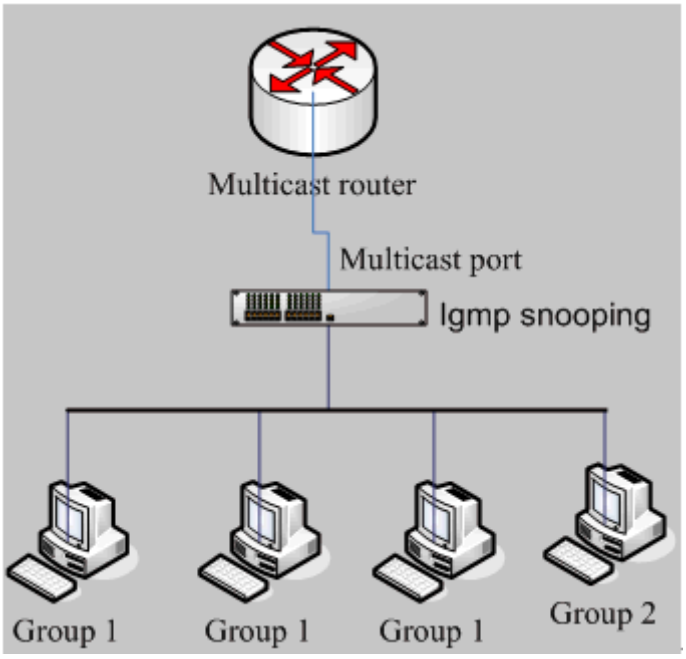


Fig 11-1 Enabling IGMP Snooping function

Example: As shown in the above figure, a VLAN 100 is configured in the switch and includes ports 1, 2, 6, 10 and 12. Four hosts are connected to port 2, 6, 10, 12 respectively and the multicast router is connected to port 1. As IGMP Snooping is disabled by default either in the switch or in the VLANs, If IGMP Snooping should be enabled in VLAN 100, the IGMP Snooping should be first enabled for the switch in Global Mode and in VLAN 100 and set port 1 of VLAN 100 to be the M-Router port.
The configuration steps are listed below：
switch#config
switch (config)#ip igmp snooping
switch (config)#ip igmp snooping vlan 100
switch (config)#ip igmp snooping vlan 100 mrouter-port interface ethernet 0/0/1

Multicast Configuation:
Assuming that there are two multicast servers: Multicast Server 1and Multicase Server 2. Multicast Server 1 provides program1 and program 2 while the Multicast Server 2 provides program3. And they use group addresses Group1，Group2 and Group 3 respectively. There are four hosts running multicast application software simultaneously, the two of which connected to port 2 and 6 order program 1, the one connected to port 10 orders program2 and the other one connected to port 12 orders program 3
IGMP Snooping listening result:
The multicast table built by IGMP Snooping in VLAN 100 indicates ports 1, 2, 6, 10 in Group1 and ports 1, 12 in Group3.
All the four hosts can receive the program of their choice: ports 2, 6, 10 will not receive the traffic of program 2,3and port 12 will not receive the traffic of program 1,2.

Scenario 2：IGMP L2-general-querier

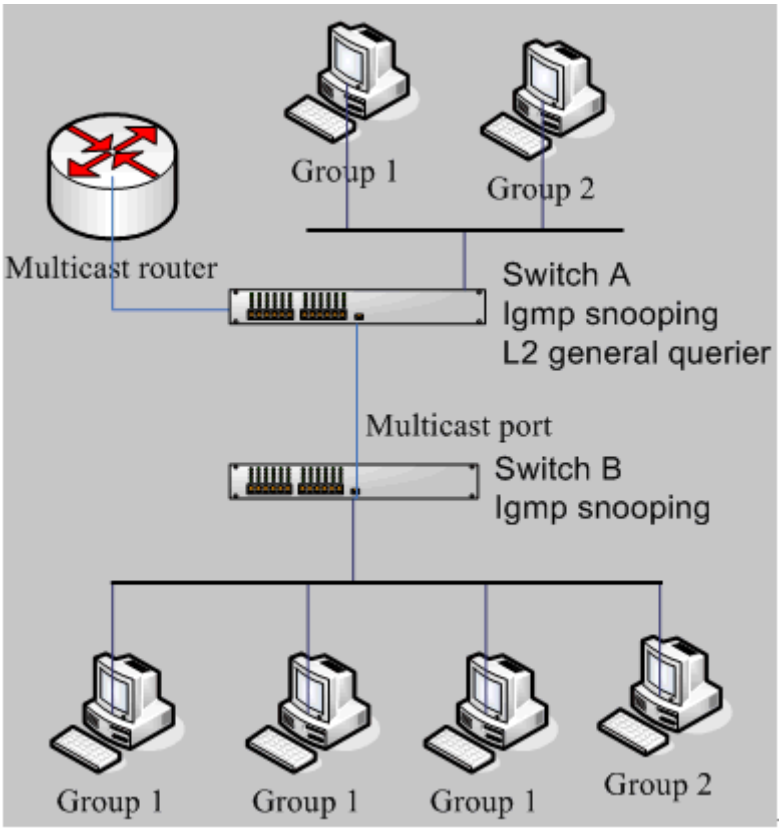


Fig 11-2 The switches as IGMP Queries

The configuration of Switch2 is the same as the switch in scenario 1, SwitchA takes the place of Multicast Router in scenario 1. Let's assume VLAN 60 is configured in SwitchA, including ports 1, 2, 6, 10 and 12. Port 1 connects to the multicast server, and port 2 connects to Switch2. In order to send Query at regular interval, IGMP query must enabled in Global mode and in VLAN60.

The configuration steps are listed below:

```
switchA#config
switchA(config)#ip igmp snooping
switchA(config)#ip igmp snooping vlan 60
switchA(config)#ip igmp snooping vlan 60 l2-general-querier

switchB#config
switchB(config)#ip igmp snooping
switchB(config)#ip igmp snooping vlan 100
switchB(config)#ip igmp snooping vlan 100 mrouter interface ethernet 0/0/1
```

Multicast Configuration
The same as scenario 1.
IGMP Snooping listening result:
Similar to scenario 1.

11.4 IGMP Snooping Troubleshooting

11.4.1 IGMP Snooping Monitor and Debug Command List

11.4.1.1 debug igmp snooping all/packet/event/timer/mfc

Command：debug igmp snooping all/packet/event/timer/mfc
no debug igmp snooping all/packet/event/timer/mfc
Function：Enable the IGMP Snooping debug switch of the switch; the 'no debug igmp snooping all/packet/event/timer/mfc' command is to disable the debug switch.
Command mode：Admin Mode
Default Setting：By default the IGMP Snooping debug switch of the switch is disabled.
Usage Guide: The command is used for enable the IGMP Snooping debugging switch of the switch, switch IGMP data packet message can be shown with 'packet' parameter, event message with 'event', timer message with 'time', down sending hardware entries message with 'mfc', and all debugging messages with 'all'.

11.4.1.2 show ip igmp snooping

Command：show ip igmp snooping [vlan <vlan-id>]
Parameter: <*vlan-id*> is vlan number of specify display IGMP Snooping information
Command mode: Admin Mode
Usage Guide: If no vlan number is specified, it will show whether global igmp snooping switch is on, which vlan is configured with l2-general-querier function, and if a vlan number is specified, detailed IGMP messages for this vlan will be shown
Example:
1. Display the summary infromation of IGMP Snooping of the switch
Switch(config)#show ip igmp snooping
Global igmp snooping status: Enabled
Igmp snooping is turned on for vlan 1(querier)
Igmp snooping is turned on for vlan 2

Displayed Informaton	Explanation
Global igmp snooping status	Whether the global igmp snooping switch of the switch

	is enabled.
Igmp snooping is turned on for vlan 1(querier)	Which vlans of the switch enable igmp snooping function, and whether they are l2-general-queriers

2. Display the detailed information of IGMP Snooping of vlan1

Switch#show ip igmp snooping vlan 1

Igmp snooping information for vlan 1

Igmp snooping L2 general querier :Yes(COULD_QUERY)
Igmp snooping query-interval :125(s)
Igmp snooping max reponse time :10(s)
Igmp snooping robustness :2
Igmp snooping mrouter port keep-alive time :255(s)
Igmp snooping query-suppression time :255(s)

IGMP Snooping Connect Group Membership
Note:*-All Source, (S)- Include Source, [S]-Exclude Source

Groups	Sources	Ports	Exptime	System Level
238.1.1.1	(192.168.0.1)	Ethernet0/0/8	00:04:14	V2
	(192.168.0.2)	Ethernet0/0/8	00:04:14	V2

Igmp snooping vlan 1 mrouter port
Note:'!'-static mrouter port
!Ethernet0/0/2

Displayed Informaton	Explanation
Igmp snooping L2 general querier	Whether vlan has started l2-general-querier function; and display the state of the querier: could-query or suppressed
Igmp snooping query-interval	The query interval of the vlan
Igmp snooping max reponse time	The max reponse time of the vlan
Igmp snooping robustness	The robustness of the vlan
Igmp snooping mrouter port keep-alive time	The keep-alive time vlan of the vlan
Igmp snooping query-suppression time	The query-suppression time of the vlan as a l2-general-querier
IGMP Snooping Connect Group Membership	The group membership of the vlan，that is the corresponding relationship between the port and（S,G）.
Igmp snooping vlan 1 mrouter port	The mrouter port of the vlan, including static and dynamic.

11.4.1.3 show mac-address-table multicast

Command: show mac-address-table multicast
Function: Show the multicast MAC address table messages
Parameter: None
Command mode: Admin Mode
Default: Not showing the multicast MAC address and port mapping by system default
Usage Guide: This command shows multicast MAC address table messages of current switch
Example: Show the multicast mapping in vlan 100

Vlan	Mac Address	Type	Creator	Ports
1	01-00-5e-01-01-01	MULTI	IGMP	Ethernet0/0/20

11.4.2 IGMP Snooping Troubleshooting

When configuring and using IGMP Snooping function, users might find that the IGMP Snooping work abnormally, probablely because of the reasons like incorrect physical connection and configuration. So, the user should ensure the following:

- Guarantee that the physical connection is corretct;
- Ensure that the IGMP Snooping is enabled in global configuration mode（using ip igmp snooping）；；
- Ensure that vlan has configured with IGMP Snooping in global configuration mode（using ip igmp snooping vlan <vlan-id>）；
- Ensure that a vlan is configured as a layer 2 general queirer or a static mrouter is configured in the same segment.
- Check the validityof IGMP Snooping information usingcommand’show ip igmp snooping vlan <vid>‘.

If all the above ways cannot solve the problems of IGMP Snooping, please use debug commands like’ debug igmp snooping’ , then copy the DEBUG information in 3miniutes and send the information to the technical service center of our company.

Chapter 12 Multicast VLAN Configuration

12.1 Multicast VLAN Introduction

Based on the current multicast program ordering method, when users in different VLANs order programs, each VLAN will copy a multicast stream within itself. This method will waste lots of bandwidth. So by configuring multicast VLAN, we add the ports of a switch to a multicast VLAN, after enabling the IGMP Snooping function, we can make users in different VLANs share a same multicast VLAN, and limit the transmission of multicast stream within only one multicast VLAN. Thus, bandwidth will be saved. Since the multicast VLAN and user VLAN are completely isolated, both the security and the bandwidth can be guaranteed. After we configure the multicast VLAN, we can ensure that the multicast information stream can be sent to users without a stop.

12.2 Multicast VLAN Configuration

12.2.1 Multicast VLAN Configuration Task List

1. Start multicast VLAN function
2. Configure IGMP Snooping

1. Start multicast VLAN function

Command	Explanation
VLAN configuration mode	
multicast-vlan **no multicast-vlan**	Configure a VLAN to start the multicast VLAN function. The ‘ no multicast-vlan’ command will disable the multicast VLAN function of the VLAN.
multicast-vlan association <*vlan-list*> **no multicast-vlan association <*vlan-list*>**	Associate a multicst VLAN to other VLANs. The ‘ no multicast-vlan association <vlan-list>‘ command will delete the associated VLANs of the multicast VLAN.

2. Configure IGMP Snooping

Command	Explanation
Global configuration mode	
ip igmp snooping vlan <*vlan-id*> **no ip igmp snooping vlan <*vlan-id*>**	Start the IGMP Snooping function of the multicast vlan. ‘no ip igmp snooping vlan

	<vlan-id>‘ command will disable the IGMP Snooping function of the multicast vlan.
ip igmp snooping **no ip igmp snooping**	Start the IGMP Snooping function. The ‘no ip igmp snooping‘ command will disable the IGMP Snooping function globally.

12.2.2 Multicast VLAN Configuration Command List

12.2.2.1 multicast-vlan

Command: multicast-vlan
no multicast-vlan
Function: Enable multicast VLAN function on a VLAN; the ‘no’ form of this command disables the multicast VLAN function.
Parameter: None
Command mode: VLAN configuration mode
Default: Multicast VLAN function not enabled by default
Usage Guide: The multicast VLAN function can not be enabled on private VLAN. To disable the multicast VLAN function of the VLAN, configuration of VLANs associated with the multicast VLAN should be deleted. Note that the default vlan can not be configured with this command and only one multicast vlan is allowed on a switch
Examples:
Switch(config)#vlan 2
Switch (Config-Vlan2)# multicast vlan

12.2.2.2 multicast-vlan association <*vlan-list*>

Command: multicast-vlan association <vlan-list>
no multicast-vlan association <vlan-list>
Function: Associate several VLANs with a multicast VLAN; the ‘no’ form of this command cancels the association relations.
Parameter: <*vlan-list*> the VLAN ID list associated with multicast VLAN. Each VLAN can only be associated with one multicast VLAN and the association will only succeed when every VLAN listed in the VLAN ID table exists.
Command mode: VLAN Mode
Default: The multicast VLAN is not associated with any VLAN by default
Usage Guide: After a VLAN is associated with the multicast VLAN, when there comes the multicast order in the port of this VLAN, then the multicast data will be sent from the multicast VLAN to this port, so to reduce the data traffic. The VLAN associated with the multicast VLAN should not be a Private VLAN. A VLAN can only be associated with another VLAN after the multicast VLAN is enabled. Only one multicast VLAN can be enabled on a switch.
Examples:

Switch(config)#vlan 2
Switch (Config-Vlan2)#multicast-vlan
Switch (Config-Vlan2)# multicast-vlan association 3, 4

12.3 Multicast VLAN Example

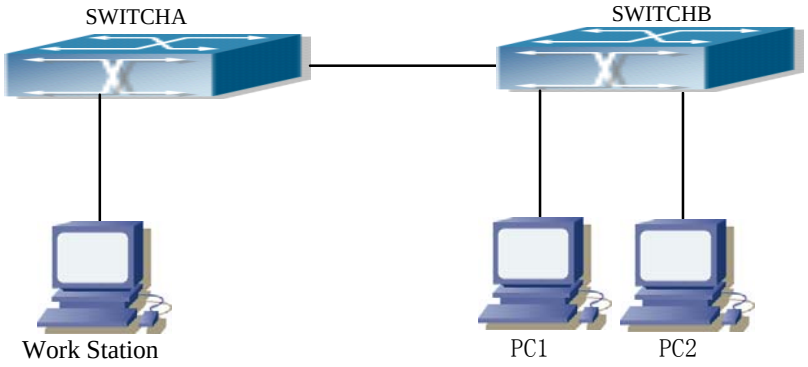


Fig 12-1 The function configuration of multicast VLAN

As showed in the picture above, multicast server connects to a 3-layer switch switchA via port 0/0/1,and the port 0/0/1 belongs to the vlan10 of the switch. 3-lay switch switchA connects to 2-layer switch switchB via port . Vlan 20 is a multicast vlan. The vlan 100 of switchB includes port 0/0/15，vlan101 includes port 0/0/20. PC1 and PC2 connect to port 0/0/15 and respectively. switchB connects to switchA via port . Vlan20 is a multicast vlan.

By configuring multicast VLAN, we can make PC1 and PC2 to receive multicast data viamulticast VLAN.

The following configuration is based on the assupmtion that the IP address of switchA has been configured, and the devices are connected correctly.

The following is the configuration procedure:

SwitchA#config
SwitchA (config)#vlan 10
SwitchA (config-vlan10)#switchport access ethernet 0/0/1
SwitchA (config-vlan10)exit
SwitchA (config)#vlan 20
SwitchA (config-vlan20)#exit
SwitchA (config)#ip igmp snooping
SwitchA (config)#ip igmp snooping vlan 20
SwitchA (config)# interface ethernet 0/0/10
SwitchA (Config-Ethernet0/0/10)switchport mode trunk
SwitchB#config

SwitchB (config)#vlan 100
SwitchB (config-vlan100)#switchport access ethernet 0/0/15
SwitchB (config-vlan100)exit
SwitchB#config
SwitchB (config)#vlan 101
SwitchB (config-vlan101)#switchport access ethernet 0/0/20
SwitchB (config-vlan101)exit
SwitchB (config)# interface ethernet 0/0/10
SwitchB (Config-Ethernet0/0/10)#switchport mode trunk
SwitchB (Config-Ethernet0/0/10)#exit
SwitchB (config)#vlan 20
SwitchB (config-vlan20)#multicast-vlan
SwitchB (config-vlan20)#multicast-vlan association 100,101
SwitchB (config-vlan20)#exit
SwitchB (config)#ip igmp snooping
SwitchB (config)#ip igmp snooping vlan 20

Chapter 13 DCSCM Configuraion

13.1 DCSCM Introduction

DCSCM（security control multicast）technology includes three respects: multicast source controllabillity, multicast users controllabillity and the service-priority-oriented multicast policy.

The DCSCM technology mainly uses the following methods to realize multicast source controllabillity:

a) On the boundary switch, if configured the source-controlled multicast, only the muticast data of the specified group sent by specified source can pass.
b) For the RP switch at the PIM-SM core state, REGISTER_STOP will be directly sent for all the REGISTER information besides than the specified source and group.Creating list entries is not allowed.（This task is implemented in PIM-SM module）.

The implementation of DCSCM technology is based on the contro lboer the IGMP report messages from users, so the controlling modules are IGMP snooping module and IGMP module. The control logic of it includes the following three methods: control according to the source VLAN+MAC address of the message, control according to the source IP address of the message, and control according to the port through which the message enters.IGMP snooping can use all the three methods while the IGMP, since it is at layer 3, can only control according to the source IP address of the messgae.

The service-priority-oriented mutilcast policy of DCSCM technology adpots the following methods：For the multicast data within a limited range, the user-specified priority is set at the access point, making data be transmitted on TRUNK at a higher priority, and thus ensuring the data to be transmitted through the whole network at the user-specified priority.

13.2 DCSCM Configuration

13.2.1 DCSCM Configuration Task List

（1） Configuration of source control
（2） Configuration of destination control
（3） Configuration of multicast policy.

1. Configuration of source control

Configuration of source control can be divided into three parts, the first is to enable the source control globally, the following is the command to do this:

Command	Explantation
Global configuration mode	
[no] ip multicast source-control(necessary)	Enable the source control globally, the '[no] ip multicast source-control' command will disable the source control globally. What calls for attention is that after the global source control is enabled; all the multicast messages will be dumped by default. All the souce control configuration can only be done after it is enabled globally, and only when all the configured rules has been disabled, can the souce control be disabled globally.

The next is the configuration of the rules of source control. It adopts the same method adopted by ACL, using ACL ID from 5000 to 5099 的 ACL, each rule ID can configure 10 rules at most. What calls for attention is that, these rules has a sequence, the rule configured earliest is at the front, once it is matched, all the following rules will be neglected. So the rules that are allowed globally should be configured as the last rule. The following is the command to do this

Command	Explantation
Global configuration mode	
[no] access-list <*5000-5099*> {deny|permit} ip {{<*source*> <*source-wildcard*>}|{host-source <*source-host-ip*>}|any-source} {{<*destination*> <*destination-wildcard*>}|{host-destination <*destination-host-ip*>}|any-destination}	To configure the rules used in source control. The rule can only take effect on specified port. Prefixing the command with 'NO' will delete the specified rule.

Attention：Since the configured rules take up the list entries of hardware, too many rules might cause the configuration to fail because the underlying list entries are full. So we recommend that users should use rules as simple as possible.The following is the command to configure.

Command	Explantation
Port configuration mode	
[no] ip multicast source-control access-group <*5000-5099*>	To configure the rule used in source control to a port, prefixing the command with 'NO' will cancel the configuration.

2. Configuration of destination control

Similar to the configuration of source control, it has three steps:

The first step is to globally enable destination control, since the destination control should prevent the unauthorized users to receive the multicast data, after the global

destination control, the switch will not broadcast the multicast data it receives. So, we should avoid connecting two or more other 3-layer switches to a switch with destination control enabled within one VLAN.The following is the command to configure:

Command	Explantation
Global configuration mode	
[no] ip multicast destination-control(necessary)	Enable the destination globally. The' no ip multicast destination-contro' command will disable the destination control globally.Only after the desination control is enabled globally, all of the other configurations can take effect.

The next step is to configure the destination control rules, which is also similar to that ofsource control except that it uses ACL ID from 6000 to 7999.

Command	Explantation
Global configuration mode	
[no] access-list <*6000-7999*> {deny|permit} ip {{<*source*> <*source-wildcard*>}|{host-source <*source-host-ip*>}|any-source} {{<*destination*> <*destination-wildcard*>}|{host-destination <*destination-host-ip*>}|any-destination}	Configure the rule used in destination control. The rule can only take effect when applied to specified source IP or VLAN-MAC and port. Prefixing the command with 'NO' can delete the specified rule.

The last step is to configure the rule to specified source IP, source VLAN MAC or port.What calls for attention is that, taking the above statement, only after enabling IGMP-SNOOPING can we use the rules globally, if not, only source IP rules can be used in IGMP protocol. If we configure source IP,VLAN MAC and specified port rules, the rules are matched to messages in a sequence as VLAN MAC, sourve IP, specified ports. The folloing is the command to configure:

Command	Explantation
Port configuration mode	
[no] ip multicast destination-control access-group <*6000-7999*>	To configure the rule used in source control to a port, prefixing the command with 'NO' will cancel the configuration.
Global configuration mode	
[no] ip multicast destination-control <*1-4094*> <*macaddr*> access-group <*6000-7999*>	To configure the rule used in source control to specified VLAN-MAC, prefixing the command with 'NO' will cancel the configuration.
[no] ip multicast destination-control <*source*> <*source-wildcard*> access-group <*6000-7999*>	To configure the rule used in source control to specified source IP address/MASK, prefixing the command with 'NO' will cancel the configuration.

3. Configuration of mulicast policy

Mulicast policy satisfies the demand of special users by designating priority for specified multicast data. What calls for attention is that multicast data can only be taken special care when it is transmitted on TRUNK . The following is the command to configure (set a priority for the specified multgicast):

Command	Explantation
Global configuration mode	
[no] ip multicast policy <*source*> <*source-wildcard*> <*destination*> <*destination-wildcard*> cos <*priority*>	Configure the multicast policy, set priority for source within a special range. The range of priority is <0-7>.

13.2.2 DCSCM Command List

13.2.2.1 access-list (Multicast Source Control)）

Command: access-list <5000-5099> {deny|permit} ip {{<source> <source-wildcard>}|{host <source-host-ip>}|any} {{<destination> <destination-wildcard>}|{host-destination <destination-host-ip>}|any-destination}
no access-list <5000-5099> {deny|permit} ip {{<source> <source-wildcard>}|{host <source-host-ip>}|any} {{<destination> <destination-wildcard>}|{host-destination <destination-host-ip>}|any-destination}

Function: Configure source control multicast access-list; the '**no access-list <5000-5099> {deny|permit} ip {{<source> <source-wildcard>}|{host <source-host-ip>}|any} {{<destination> <destination-wildcard>}|{host-destination <destination-host-ip>}|any-destination}**' command deletes the access-list.

Parameter: **<5000-5099>:** source control access-list number.
{deny|permit}: deny or permit.
<source>: multicast source address.**<source-wildcard>:** multicast source address wildcard character.
<source-host-ip>: multicast source host address.
<destination>: multicast destination address.
<destination-wildcard>: multicast destination address wildcard character.
<destination-host-ip>: multicast destination host address.

Default: None

Command mode: Global Mode

Usage Guide: ACL of Multicast source control list item is controlled by specifical ACL number from 5000 to 5099, the command applies to configure this ACL. ACL of Multicast source control only needs to configure source IP address and destination IP address controlled (group IP address), the configuration mode is basically the same to other

ACLs, and use wildcard character to configure address range, and also specify a host address or all address. Remarkable, 'all address' is 224.0.0.0/4 according to group IP address, not 0.0.0.0/0 in other access-list.

Example: 0.0.0.255

Switch(Config)#access-list 5000 permit ip 10.1.1.0 0.0.0.255 232.0.0.0 0.0.0.255

13.2.2.2 access-list (Multicast Destination Control)

Command: access-list <6000-7999> {deny|permit} ip {{<source> <source-wildcard>}|{host <source-host-ip>}|any} {{<destination> <destination-wildcard>}|{host-destination <destination-host-ip>}|any-destination}

no access-list <6000-7999> {deny|permit} ip {{<source> <source-wildcard>}|{host <source-host-ip>}|any} {{<destination> <destination-wildcard>}|{host-destination <destination-host-ip>}|any-destination}

Function: Configure destination control multicast access-list, the '**no access-list <6000-7999> {deny|permit} ip {{<source> <source-wildcard>}|{host <source-host-ip>}|any} {{<destination> <destination-wildcard>}|{host-destination <destination-host-ip>}|any-destination}**' command deletes the access-list.

Parameter: <6000-7999>: destination control access-list number.

{deny|permit}: deny or permit.

<source>: multicast source address.

<source-wildcard>: multicast source address wildcard character..

<source-host-ip>: multicast source host address.

<destination>: multicast destination address.

<destination-wildcard>: multicast destination address wildcard character.

<destination-host-ip>: multicast destination host address

Default: None

Command mode: Global Mode

Usage Guide:

ACL of Multicast destination control list item is controlled by specifical ACL number from 6000 to 7999, the command applies to configure this ACL. ACL of Multicast destination control only needs to configure source IP address and destination IP address controlled (group IP address), the configuration mode is basically the same to other ACLs, and use wildcard character to configure address range, and also specify a host address or all address. Remarkable, 'all address' is 224.0.0.0/4 according to group IP address, not 0.0.0.0/0 in other access-list.IGMP Snooping V2 only support <*,G> but not support <S,G>, so.the ACL with the<source> as any source,then the IGMP Snooping V2 can use.

Example<*,G> but can not support <S,G>

Switch(Config)#access-list 6000 permit ip 10.1.1.0 0.0.0.255 232.0.0.0 0.0.0.255

13.2.2.3 ip multicast source-control

Command: ip multicast source-control
no ip multicast source-control

Function: Configure to globally enable multicast source control, the '**no ip multicast source-control**' command restores global multicast source control disabled.

Parameter: None

Default: Disabled

Command mode: Global Mode

Usage Guide:

The source control access-list applies to interface with only enabling global multicast source control, and configure to disabled global multicast source control without configuring source control access-list on every interface. After configuring the command, multicast data received from every interface does not have matching multicast source control list item, and then they will be thrown away by switches, namely only multicast data matching to PERMIT can be received and forwarded.

Example:

Switch(Config)#ip multicast source-control

13.2.2.4 ip multicast source-control access-group

Command: ip multicast source-control access-group <5000-5099>
no ip multicast source-control access-group <5000-5099>

Function: Configure multicast source control access-list used on interface, the 'no ip multicast source-control access-group <5000-5099>'command deletes the configuration.

Parameter: <5000-5099>: Source control access-list number**.**

Default: None

Command mode: Interface configuration mode

Usage Guide:

The command configures with only enabling global multicast source control. After that, it will match multicast data message imported from the interface according to configured access-list, such as matching: permit, the message will be received and forwarded; otherwise the message will be thrown away.

Example:

Switch(Config)#interface ethernet 0/0/1
Switch(Config-Ethernet0/0/1)#ip multicast source-control access-group 5000

13.2.2.5 ip multicast destination-control access-group

Command: ip multicast destination-control access-group <6000-7999>
no ip multicast destination-control access-group <6000-7999>

Function: Configure multicast destination-control access-list used on interface, the '**no ip multicast destination-control access-group <6000-7999>**'command deletes the configuration.

Parameter: <6000-7999>: destination-control access-list number.

Default: None

Command mode: Port Mode

Usage Guide:

The command is only working under global multicast destination-control enabled, after configuring the command, if IGMP-SPOOPING is enabled, for adding the interface to multicast group, and match configured access-list, such as matching: permit, the interface can be added, otherwise do not be added.

Example:

Switch(Config)#interface ethernet 0/0/1

Switch(Config-Ethernet0/0/1)#ip multicast destination-control access-group 6000

13.2.2.6 ip multicast destination-control access-group (vmac)

Command: ip multicast destination-control <1-4094> <macaddr >access-group <6000-7999>

no ip multicast destination-control <1-4094> <macaddr >access-group <6000-7999>

Function: Configure multicast destination-control access-list used on specified vlan-mac, the '**no ip multicast destination-control <1-4094> <macaddr >access-group <6000-7999>**' command deletes this configuration.

Parameter: **<1-4094>:** VLAN-ID;

<macaddr>: Transmitting source MAC address of IGMP-REPORT, the format is 'xx-xx-xx-xx-xx-xx';

<6000-7999>: Destination-control access-list number.

Default: None

Command mode: Global Mode

Usage Guide: The command is only working under global multicast destination-control enabled, after configuring the command, if IGMP-SPOOPING is enabled, for adding the members to multicast group. If configuring multicast destination-control to source MAC address of transmitted igmp-report, and match configured access-list, such as matching: permit, the interface can be added, otherwise do not be added.

Example:

Switch(Config)#ip multicast destination-control 1 00-01-03-05-07-09 access-group 6000

13.2.2.7 ip multicast destination-control access-group (sip)

Command: ip multicast destination-control <IPADDRESS/M> access-group <6000-7999>

no ip multicast destination-control <IPADDRESS/M> access-group <6000-7999>

Function: Configure multicast destination-control access-list used on specified net segment, the '**no ip multicast destination-control <IPADDRESS/M> access-group <6000-7999>**' command deletes this configuration.

Parameters: **<IPADDRESS/M>:** IP address and mask length;;

<6000-7999>: Destination control access-list number.

Default: None

Command mode: Global Mode

Usage Guide:

The command is only working under global multicast destination-control enabled, after configuring the command, if IGMP-SPOOPING or IGMP is enabled, for adding the members to multicast group. If configuring multicast destination-control on specified net segment of transmitted igmp-report, and match configured access-list, such as matching permit, the interface can be added, otherwise do not be added. If relevant group or source in show ip igmp groups detail has been established before executing the command, it needs to execute clear ip igmp groups command to clear relevant groups in Admin mode.

Example:

Switch(Config)#ip multicast destination-control 10.1.1.0 255.255.255.0 access-group 6000

13.2.2.8 ip multicast destination-control

Command: ip multicast destination-control

no ip multicast destination-control

Function: Configure to globally enable multicast destination-control, the '**no ip multicast destination-control**' command restores disabled global multicast group control.

Parameter: None

Default: Disabled

Command mode: Global Mode

Usage Guide:

Other destination control configurations can be taken effect with only enabling global multicast destination control, the destination control access-list applies to interface, VLAN-MAC and SIP. After configuring the command, igmp snooping and IGMP match, according to above rules, when they receive IGMP REPORT to try to add interface.

Example:

Switch(Config)#ip multicast destination-control

13.2.2.9 ip multicast policy

Command: ip multicast policy <IPADDRESS/M> <IPADDRESS/M> cos <priority>

no ip multicast policy <IPADDRESS/M> <IPADDRESS/M> cos

Function: Configure multicast policy, the '**no ip multicast policy <IPADDRESS/M> <IPADDRESS/M> cos**' command deletes it.

Parameters: <IPADDRESS>: are multicast source address, source adapter identifier, destination address, and destination adapter identifier separately.

<IPADDRESS/M>: are multicast source address, mask length, destination address, and mask length separately.

<priority>: specified priority, range from 0 to 7

Default: None

Command mode: Global Mode

Usage Guide:

The command configuration modifies to a specified value through the switch matching priority of specified range multicast data package, and the TOS is specified to the same value simultaneously. Carefully, the packet transmitted in UNTAG mode does not modify its priority.

Example:

Switch(Config)#ip multicast policy 10.1.1.0 0.0.0.255 225.1.1.0 0.0.0.255 cos 7

13.3 DCSCM Typical Example

1. Souce control

To prevent a boundary switch to send multicast data freely, we configure on the boundary switch that, only the switch connected to port Ethernet0/0/5 is allowed to send multicast data, and the group of the data has to be 225.1.2.3. But the uplink port Ethernet0/0/25 can forward multicast data without limitation. The following is the configuration we can make:

Switch(Config)#access-list 5000 permit ip any host 225.1.2.3
Switch(Config)#access-list 5001 permit ip any any
Switch(Config)#ip multicast source-control
Switch(Config)#interface Ethernet0/0/5
Switch(Config-If-Ethernet0/0/5)#ip multicast source-control access-group 5000
Switch(Config)#interface Ethernet0/0/25
Switch(Config-If-Ethernet0/0/25)#ip multicast source-control access-group 5001

2. Destination control

We can confiure as follows if we want to prevent the users in 10.0.0.0/8 segment to join the group 238.0.0.0/8：

Firstly, to enable IGMP snooping in the VLAN it is in(assumed to be VLAN2)
Switch(Config)#ip igmp snooping
Switch(Config)#ip igmp snooping vlan 2

Then, configure the relative detination control ACL, and configure the specified IP to use the ACL.

Switch(Config)#access-list 6000 deny ip any 238.0.0.0 0.255.255.255
Switch(Config)#access-list 6000 permit ip any any
Switch(Config)#ip multicast destination-control
Switch(Config)#ip multicast destination-control 10.0.0.0 0.255.255.255 access-group 6000

Thus, the users of this segment can only join the groups other than 238.0.0.0/8

3. Multicast policy

Server 210.1.1.1 is sending important multicast data in the group 239.1.2.3 上, we can configure as follows on its access switch :

Switch(Config)#ip multicast policy 210.1.1.1 0.0.0.0 239.1.2.3 0.0.0.0 cos 4

Thus when the multicast strem is passing the TRUNK of this switch to other switches,

it will be at priority 4(usually it is a high priority, the higher might be protocol data, but if we set higher priority, when there is too much multicast data, may cause abnormal behavior of the switch protocol)

13.4 DCSCM Troubleshooting

13.4.1 DCSCM Debug and Monitor Command List

13.4.1.1 show ip multicast source-control access-list

Command: show ip multicast source-control access-list
show ip multicast source-control access-list <5000-5099>
Function: Display the configured source control multicast ACL.
Parameters： *<5000-5099>*: ACL ID
Default：None.
Command mode：Admin Mode
Example:
Switch#sh ip multicast source-control access-list
access-list 5000 permit ip 10.1.1.0 0.0.0.255 232.0.0.0 0.0.0.255
access-list 5000 deny ip 10.1.1.0 0.0.0.255 233.0.0.0 0.255.255.255

13.4.1.2 show ip multicast destination-control access-list

Command: show ip multicast destination-control access-list
show ip multicast destination-control access-list <6000-7999>
Function： Display the configured destination control multicast ACL,
Parameters： *<6000-7999>*: ACL ID.
Default：None.
Command mode：Admin Mode
Usage Guide: The command displays destination control multicast access-list of configuration.
Example:
Switch#sh ip multicast destination-control acc
access-list 6000 deny ip any-source any-destination
access-list 6000 deny ip any-source host-destination 224.1.1.1
access-list 6000 deny ip host-source 2.1.1.1 any-destination
access-list 6001 deny ip host-source 2.1.1.1 225.0.0.0 0.255.255.255
access-list 6002 permit ip host-source 2.1.1.1 225.0.0.0 0.255.255.255
access-list 6003 permit ip 2.1.1.0 0.0.0.255 225.0.0.0 0.255.255.255

13.4.1.3 show ip multicast policy

Command: show ip multicast policy
Function： Display the configured multicast policy.
Parameters： None.
Default：None.
Command mode：Admin Mode
Usage Guide: The command displays multicast policy of configuration
Example:
Switch#show ip multicast policy
ip multicast-policy 10.1.1.0 0.0.0.255 225.0.0.0 0.255.255.255 cos 5

13.4.1.4 show ip multicast source-control

Command: show ip multicast source-control [detail]
show ip multicast source-control interface <Interfacename> [detail]
Function： Display the multicst control configuration.
Parameters： **detail**：whether display detailed information.
<Interfacename>：interface name，like Ethernet 0/0/1or ethernet 0/0/1。
Default：None.
Command mode：Admin Mode
Usage Guide: The command displays multicast source control rules of configuration, including detail option, and access-list information applied in detail
Example:
Switch#show ip multicast source-control detail
ip multicast source-control is enabled
Interface Ethernet0/0/1 use multicast source control access-list 5000
access-list 5000 permit ip 10.1.1.0 0.0.0.255 232.0.0.0 0.0.0.255
access-list 5000 deny ip 10.1.1.0 0.0.0.255 233.0.0.0 0.255.255.255

13.4.1.5 show ip multicast destination-control

Command: show ip multicast destination-control [detail]
show ip multicast destination-control interface <Interfacename> [detail]
show ip multicast destination-control host-address <ipaddress> [detail]
show ip multicast destination-control <vlan-id> <mac-address> [detail]
Function：Display the multicast destination configuration
Parameters： **detail**：whether display detailed information.
<Interfacename>：interface name，like Ethernet 0/0/1 or port-channel 1 or ethernet 0/0/1。
Default：None.
Command mode：Admin Mode
Usage Guide:
The command displays multicast destination control rules of configuration, including

detail option, and access-list information applied in detail.

Example:

Switch (Config)#show ip multicast destination-control
ip multicast destination-control is enabled
ip multicast destination-control 11.0.0.0 0.255.255.255 access-group 6003
ip multicast destination-control 1 00-03-05-07-09-11 access-group 6001
multicast destination-control access-group 6000 used on interface Ethernet 0/0/1

13.4.2 DCSCM Troubleshooting

DCSCM module has similar function with ACL, the problems usually relate with incorrect configuration. Please read the instruction above carefully. If you still cannot pin down the cause of the problems, please send your configuration and the effect you expect to the after-sale personnels of Digital China Limited.

Chapter 14 802.1x Configuration

14.1 Introduction to 802.1x

IEEE 802.1x is a port-based network access management method, which authenticates and manages the accessing devices on the physical access level of the LAN device. The physical access level here is the ports of the switch. If the users' devices connected to such ports can be authenticated, access to resources in the LAN is allowed; otherwise, access will be denied, which is essentially the same as disconnecting physically.

IEEE 802.1x defines a port-based network access management protocol. It should be noted that the protocol applies to point-to-point connection between the accessing device and the access port, where the port can be either a logical port or a physical port. Typically, one physical port of the switch connects with one terminal device (physical port-based) only.

The architecture of IEEE 802.1x is shown below:

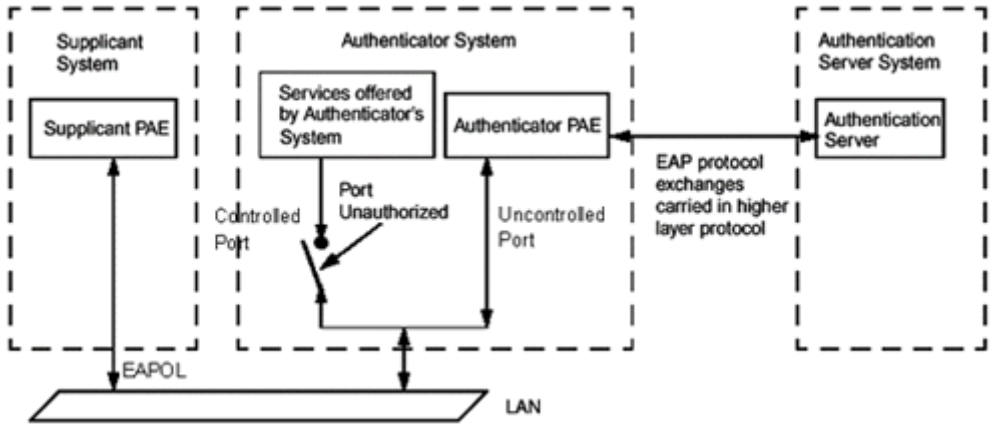


Fig 14-1 802.1x architecture

As shown in the above figure, the IEEE 802.1x architecture consists of three parts:

- Supplicant System (user access devices)
- Authenticator System (access management unit)
- Authentication Server System (the authenticating server)

EAPOL protocol defined by IEEE 802.1x runs between the user access device (PC) and access management unit (access switch); and EAP protocol is also used between the access management unit and authenticating server. EAP packets encapsulate the authenticating data. The EAP packet is conveyed in the packets of the higher layer protocols such as RADIUS to pass through complex network to the authenticating server.

The ports provided by the port-based network access management device end are divided into two virtual port types: managed port and non-managed port. A non-managed port is always in the connected status for both in and out directions to transfer EAP

authenticating packets. A managed port will be in the connected status when authorized to transfer commutation packets; and is shutdown when not authorized, and cannot transfer any packets.

In the IEEE 802.1x application environment, DCS-3950 series is used as the access management unit, and the user connection device is the device with 802.1x client software. An authenticating server usually resides in the Carrier's AAA center and usually is a Radius server.

The difference between user access, MAC-based IEEE 802.1x authentication is implemented in DCS-3950 series for better security and management. Only authenticated user access devices connecting to the same physical port can access the network, the unauthorized devices will not be able to access the network. In this way, even if multiple terminals are connected via one physical port, DCS-3950 series can still authenticate and manage each user access device individually.

User-based (IP address+ MAC address+ port) 802.1x authentication function is implemented on the base of MAC-based 802.1x authentication function, allowing users to access restricted resources before being authenticated. For user-based access control mode, there are two modes: standard control and advanced control. User-based standard control type does not limit the access to restricted resources, all the users of the port can access restricted resources before being authenticated, and after being authenticated, users can access all the resources; while the user-based advanced control will limit the access to restricted resources, only special users of the port can access restricted resorce before being authenticated, after passing the authentication, they can access all the resources.

14.2 802.1x Configuration

14.2.1 802.1x Configuration Task List

1. Enable IEEE 802.1x function
2. Access management unit property configuration
   1) Configure port authentication status
   2) Configure access management method for the port: MAC-based or port-based.
   3) Configure expanded 802.1x function
3. User access devices related property configuration (optional)
4. RADIUS server related property configuration
   1) Configure RADIUS authentication key.
   2) Configure RADIUS Server
   3) Configure RADIUS Service parameters.

1. Enable 802.1x function

Command	Explanation

Global Mode	
aaa enable no aaa enable	**Enables the AAA authentication function in the switch; the 'no aaa enable' command disables the AAA authentication function.**
aaa-accounting enable no **aaa-accounting** enable	**Enables the accounting function in the switch; the 'no aaa-accounting enable' command disables the accounting function**
aaa-accounting update {enable|disable}	**Enables/disables accounting update**
dot1x enable no dot1x enable	**Enables the 802.1x function in the switch and ports; the 'no dot1x enable' command disables the 802.1x function.**
dot1x privateclient enable no dot1x privateclient enable	**Enable the switch to force the client software adopts Digital China private 802.1x authentication message format; the 'no dot1x privateclient enable' command is used to disable this function, and thus allow the client software to adopt standard 802.1x authentication message format;**
dot1x user free-resource <***prefix***> <***mask***> no dot1x user free-resource	**Set the limited resources can be accessed by users; the 'no dot1x user free-resource' command is used to delete the limited resources.**

2. Access management unit property configuration

1) Configure port authentication status

Command	Explanation
Global Mode	
dot1x port-control {auto|force-authorized|force-unauthorized|vlanstyle } **no dot1x port-control**	Configures 802.1x authorized status,the ' **no dot1x port-control**' restore default configration

2) Configure port access management method

Command	Explanation
Global Mode	

dot1x port-method {macbased | portbased | userbased { standard | advanced}} **no dot1x port-method**	Sets the port access management method; the '**no dot1x port-method**' command restores MAC-based access management.
dot1x max-user macbased *<number>* **no dot1x max-user macbased**	Sets the maximum number of access users for the specified port; the '**no dot1x max-user macbased**' command restores the default setting of allowing 1 user.
dot1x max-user userbased *<number>* **no dot1x max-user userbased**	Set the max number of the users allowed to access by specified port, applied to ports using userbased access control mode; the ' no dot1x max-user userbased ' command is used to reset the default value: allowing 10 users at most.

3) Configure expanded 802.1x function

Command	**Explanation**
Global Mode	
dot1x macfilter enable no dot1x macfilter enable	**Enables the 802.1x address filter function in the switch; the 'no dot1x macfilter enable' command disables the 802.1x address filter function.**
dot1x accept-mac <mac-address> [interface <interface-name>] no dot1x accept-mac <mac-address> [interface <interface-name>]	**Adds 802.1x address filter table entry, the 'no dot1x accept-mac' command deletes 802.1x filter address table entries.**
dot1x eapor enable no dot1x eapor enable	**Enables the EAP relay authentication function in the switch; the 'no dot1x eapor enable' command sets EAP local end authentication.**
dot1x unicast enable no dot1x unicast enable	**Enable the 802.1x single-cast authentication function of the switch; the 'no dot1x unicast enable' command is used to diable the802.1x single-cast authentication function.**
dot1x BPDU_forward enable no dot1x BPDU_forward enable	**Enable the 802.1x traversal function of the switch; the 'no dot1x BPDU_forward enable ' command is used to diable the 802.1x traversal function of the switch.**
dot1x freevlan <vlanID> no dot1x freevlan	**Set the 802.1x freevlan of the switch; the' no dot1x freevlan' command is used to**

	disable the 802.1x freevlan function.

3. Supplicant related property configuration

Command	**Explanation**
Global Mode	
dot1x max-req <*count*> **no dot1x max-req**	Sets the number of EAP request/MD5 frame to be sent before the switch re-initials authentication on no supplicant response, the '**no dot1x max-req**' command restores the default setting.
dot1x re-authentication **no dot1x re-authentication**	Enables periodical supplicant authentication; the '**no dot1x re-authentication**' command disables this function.
dot1x timeout quiet-period <*seconds*> **no dot1x timeout quiet-period**	Sets time to keep silent on port authentication failure; the '**no dot1x timeout quiet-period**' command restores the default value.
dot1x timeout re-authperiod <*seconds*> **no dot1x timeout re-authperiod**	Sets the supplicant re-authentication interval; the '**no dot1x timeout re-authperiod**' command restores the default setting.
dot1x timeout tx-period <*seconds*> **no dot1x timeout tx-period**	Sets the interval for the supplicant to re-transmit EAP request/identity frame; the '**no dot1x timeout tx-period**' command restores the default setting.
Admin Mode	
dot1x re-authenticate [interface <*interface-name*>]	Enables IEEE 802.1x re-authentication (no wait timeout requires) for all ports or a specified port.

4. Authentication Server (RADIUS server) related property configuration

1) Configure RADIUS authentication key

Command	**Explanation**
Global Mode	
radius-server key <*string*> **no radius-server key**	Specifies the key for RADIUS server; the **'no radius-server key'** command deletes the key for RADIUS server.

2) Configuring RADIUS Server

Command	**Explanation**
Global Mode	
radius-server authentication host <*IPaddress*> [[port {<*portNum*>}] [primary]] **no radius-server authentication host <*IPaddress*>**	Specifies the IP address or IPv6 address and listening port number for RADIUS authentication server; the 'no radius-server authentication host <IPaddress>' command deletes the RADIUS server

radius-server accounting host <IPaddress> [[port {<*portNum*>}] [primary]] **no radius-server accounting host <*IPaddress*>**	Specifies the IP address or IPv6 address and listening port number for RADIUS accounting server; the 'no radius-server authentication host <IPaddress>' command deletes the RADIUS server

3) Configure RADIUS Service parameters.

Command	**Explanation**
Global Mode	
radius-server dead-time <*minutes*> **no radius-server dead-time**	Configures the restore time when RADIUS server is down; the '**no radius-server dead-time**' command restores the default setting.
radius-server retransmit <*retries*> **no radius-server retransmit**	Configures the re-transmission times for RADIUS; the '**no radius-server retransmit**' command restores the default setting
radius-server timeout <*seconds*> **no radius-server timeout**	Configures the timeout timer for RADIUS server; the '**no radius-server timeout**' command restores the default setting.
radius-server realtime-accounting timer <*minute*>	Set the realtime cost-counting update interval.

14.2.2 802.1x Configuration Command List

14.2.2.1 aaa enable

Command: aaa enable
no aaa enable
Function: Enable the AAA authentication function in the switch; the 'no AAA enable' command disables the AAA authentication function.
Command mode: Global Mode
Parameters: None.
Default: AAA authentication is not enabled by default.
Usage Guide: The AAA authentication for the switch must be enabled first to enable IEEE 802.1x authentication for the switch.
Example: Enable AAA function for the switch.
Switch(Config)#aaa enable

14.2.2.2 aaa-accounting enable

Command: aaa-accounting enable
no aaa-accounting enable
Function: Enable the AAA accounting function in the switch: the '**no aaa-accounting enable**' command disables the AAA accounting function.

Command mode: Global Mode
Default: AAA accounting is not enabled by default.
Usage Guide:

When accounting is enabled in the switch, accounting will be performed according to the traffic or online time for port the authenticated user is using. The switch will send an 'accounting started' message to the RADIUS accounting server on starting the accounting, and an accounting packet for the online user to the RADIUS accounting server every five seconds, and an 'accounting stopped' message is sent to the RADIUS accounting server on accounting end. Note: The switch send the 'user offline' message to the RADIUS accounting server only when accounting is enabled, the 'user offline' message will not be sent to the RADIUS authentication server.

Example: Enabling AAA accounting for the switch.
Switch(Config)#aaa-accounting enable

14.2.2.3 aaa-accounting update enable

Command: aaa-accounting update {enable|disable}
no aaa-accounting update {enable|disable}
Function: Enable or disable update for AAA accounting.
Command mode: Global Mode.
Default: AAA accounting is enabled by default.
Usage Guide: If the AAA accounting is enabled, the switch will send out accounting messages peroidically to the accounting server for every online users.
Example: Disable periodic the AAA account.
Switch(Config)#aaa-accounting update disable

14.2.2.4 dot1x accept-mac

Command: dot1x accept-mac <mac-address> [interface <interface-name>]
no dot1x accept-mac <mac-address> [interface <interface-name>]
Function: Add a MAC address entry to the dot1x address filter table. If a port is specified, the entry added applies to the specified port only. If no port is specified, the entry added applies to all the ports. The '**no dot1x accept-mac <*mac-address*> [interface <*interface-name*>]**' command deletes the entry from dot1x address filter table.
Parameters: <*mac-address*> stands for MAC address; **<*interface-name*>** for interface name and port number.
Command mode: Global Mode
Default: None.
Usage Guide:

The dot1x address filter function is implemented according to the MAC address filter table, dot1x address filter table is manually added or deleted by the user. When a port is specified in adding a dot1x address filter table entry, that entry applies to the port only; when no port is specified, the entry applies to all ports in the switch. When dot1x address filter function is enabled, the switch will filter the authentication user by the MAC address.

Only the authentication request initialed by the users in the dot1x address filter table will be accepted, the rest will be rejected.

Example: Add MAC address 00-01-34-34-2e-0a to the filter table of Ethernet 0/0/5.

Switch(Config)#dot1x accept-mac 00-01-34-34-2e-0a interface ethernet 0/0/5

14.2.2.5 dot1x bpdu-forward enable

Command: dot1x bpdu-forward enable

no dot1x bpdu-forward enable

Function: Enable the forwarding of 802.1x authentication on the switch. If no is put in front of this command, the forwarding will be disabled.

Command mode: Global Mode.

Default: 802.1x authentication forwarding on the switch is disabled by default.

Function: If

Example: Enable forwarding of 802.1x authentication messages.

Switch(Config)#dot1x bpdu-forward enable

14.2.2.6 dot1x eapor enable

Command: dot1x eapor enable

no dot1x eapor enable

Function: Enable the EAP relay authentication function in the switch; the '**no dot1x eapor enable**' command sets EAP local end authentication.

Command mode: Global Mode

Default: EAP relay authentication is used by default.

Usage Guide:

The switch and RADIUS may be connected via Ethernet or PPP. If an Ethernet connection exists between the switch and RADIUS server, the switch needs to authenticate the user by EAP relay (EAPoR authentication); if the switch connects to the RADIUS server by PPP, the switch will use EAP local end authentication (CHAP authentication). The switch should use different authentication methods according to the connection between the switch and the authentication server.

Example: Set EAP local end authentication for the switch.

Switch(Config)#no dot1x eapor enable

14.2.2.7 dot1x enable

Command: dot1x enable

no dot1x enable

Function: Enable the 802.1x function in the switch and ports: the '**no dot1x enable**' command disables the 802.1x function.

Command mode: Global Mode and Interface Mode.

Default: 802.1x function is not enabled in global mode by default; if 802.1x is enabled under Global Mode, 802.1x will not be enabled for the ports by default.

Usage Guide:

The 802.1x authentication for the switch must be enabled first to enable 802.1x authentication for the respective ports. If Spanning Tree or MAC binding is enabled on the port, or the port is a Trunk port or member of port aggregation group, 802.1x function cannot be enabled for that port unless such conditions are removed.

Example: Enable the 802.1x function of the switch and enable 802.1x for port 0/0/12.

Switch(Config)#dot1x enable

Switch(Config)#interface Ethernet 0/0/12

Switch(Config-Ethernet0/0/12)#dot1x enable

14.2.2.8 dot1x guest-vlan

Command：dot1x guest-vlan <*vlanid*>

no dot1x guest-vlan

Function：Set the guest-vlan of the specified port; the '**no dot1x guest-vlan**' command is used to delete the guest-vlan.

Parameters：***<vlanid>*** the specified Vlan id, ranging from 1 to 4095。

Command mode：Interface Mode.

Default：There is no 802.1x guest-vlan function on the port.

User Guide：The access device will add the port into Guest VLAN if there is no supplicant getting authenticated successfully in a certain stretch of time because of lacking exclusive authentication supplicant system or the version of the supplicant system being too low. In Guest VLAN, users can get 802.1x supplicant system software, update supplicant system or update some other applications(such as anti-virus software, the patches of operating system). When a user of a port within Guest VLAN starts an authentication, the port will remain in Guest VLAN in the case of a failed authentication. If the authentication finishes successfully, there are two possible results:

- The authentication server assigns an Auto VLAN, causing the port to leave Guest VLAN to join the assigned Auto VLAN. After the user gets offline, the port will be allocated back into the specified Guest Vlan.
- The authentication server assigns an Auto VLAN, then the port leaves Guest VLAn and joins the specified VLAN. When the user becomes offline, the port will be allocated to the specified GuestVlan again.

Attention:

- There can be different Guest VLAN set on different ports, while only one Guest VLAN is allowed on one port.
- Only when the access control mode is portbased, the Guest VLAN can take effect. If the access control mode of the port is macbased or userbased, the Guest VLAN can be successfully set without taking effect.

Example：Set Guest-Vlan of port Ethernet1/3 as Vlan 10.

Switch(Config-Ethernet0/0/3)#dot1xguest-vlan 10

14.2.2.9 dot1x macfilter enable

Command: dot1x macfilter enable
no dot1x macfilter enable
Function: Enables the dot1x address filter function in the switch; the '**no dot1x macfilter enable**' command disables the dot1x address filter function.
Command mode: Global Mode
Default: dot1x address filter is disabled by default.
Usage Guide: When dot1x address filter function is enabled, the switch will filter the authentication user by the MAC address. Only the authentication request initialed by the users in the dot1x address filter table will be accepted.
Example: Enable dot1x address filter function for the switch.
Switch(Config)#dot1x macfilter enable

14.2.2.10 dot1x max-req

Command: dot1x max-req <count>
no dot1x max-req
Function: Set the number of EAP request/MD5 frame to be sent before the switch re-initials authentication on no supplicant response; the '**no dot1x max-req**' command restores the default setting.
Parameters: < *count*> is the times to re-transfer EAP request/ MD5 frames, the valid range is 1 to 10.
Command mode: Global Mode
Default: The default maximum for retransmission is 2.
Usage Guide: The default value is recommended in setting the EAP request/ MD5 retransmission times.
Example: Change the maximum retransmission times for EAP request/ MD5 frames to 5 times.
Switch(Config)#dot1x max-req 5

14.2.2.11 dot1x max-user macbased

Command: dot1x max-user macbased <number>
no dot1x max-user macbased
Function: Set the maximum users allowed to connect to the port; the '**no dot1x max-user**' command restores the default setting.
Parameters: < *number*> is the maximum users allowed, the valid range is 1 to 254.
Command mode: Port configuration mode.
Default: The default maximum user allowed is 1.
Usage Guide: This command is available for ports using MAC-based access management, if MAC address authenticated exceeds the number of allowed user, additional users will not be able to access the network.
Example: Set port 0/0/3 to allow 5 users.
Switch(Config-Ethernet0/0/3)#dot1x max-user macbased 5

14.2.2.12 dot1x max-user userbased

Command: dot1x max-user userbased <number>
no dot1x max-user userbased

Function：Set the upper limit of the number of users allowed to access the specified port when using user-based access control mode; the 'no dot1x max-user userbased' command is used to reset the default value.

Parameters：***<number>*** the maximum number of users allowed to access the network, ranging from 1 to 1~256.

Command mode：Interface Mode.

Default：The maximum number of users allowed to access each port is 10 by default.

User Guide：This command can only take effect when the port adopts user-based access control mode. If the number of authenticated users exceeds the upper limit of the number of users allowed to access the network, those extra users can not access the network.

Example：Set port 1/3 to allow 5 users.

Switch(Config-Ethernet0/0/3)#dot1x max-user userbased 5

14.2.2.13 dot1x port-control

Command: dot1x port-control {auto|force-authorized|force-unauthorized }
no dot1x port-control

Function: Set the 802.1x authentication status; the '**no dot1x port-control**' command restores the default setting.

Parameters: auto enable 802.1x authentication, the port authorization status is determined by the authentication information between the switch and the supplicant; **force-authorized** sets port to authorized status, unauthenticated data is allowed to pass through the port; **force-unauthorized** will set the port to non-authorized mode, the switch will not provide authentication for the supplicant and prohibit data from passing through the port.

Command mode: Port configuration Mode

Default: When 802.1x is enabled for the port, **auto** is set by default.

Usage Guide: If the port needs to provide 802.1x authentication for the user, the port authentication mode should be set to **auto**.

Example: Set port1/1 to require 802.1x authentication mode.

Switch(Config)#interface e 0/0/1

Switch(Config-Ethernet0/0/1)#dot1x port-control auto

14.2.2.14 dot1x port-method

Command: dot1x port-method {macbased | portbased}
no dot1x port-method

Function: Set the access management method for the specified port; the '**no dot1x port-method**' command restores the default access management method.

Parameters: macbased sets the MAC-based access management method; **portbased**

sets port-based access management.
Command mode: Interface Mode
Default: None.
Usage Guide:

For MAC-based access management, Multi-user is allowed to authenticate.For port-based access management only one user is allowed to authenticate.For both MAC-based and port-based access management, None of the network resource is available for unauthorized user.

For user-based standard access management, the special network resource is available for unauthorized user, all the network resource is available for authorized user. For user-based acvanced access management, the special network resource is available only for special unauthorized user, all the network resource is available for authorized user.

Webbased access management is used mostly in L3 switch.The global configuration of WEB authentication agent and HTTP redirection address is needed before setting the port to Webbased access management. Webbased access management is conflicted with the command of 'ip dhcp snooping binding user-control'.
Notes: For user-based standard access management, 802.1x must be configed first.
Example: Setting port-based access management for port 0/0/4.
Switch(Config-Ethernet0/0/4)#dot1x port-method userbased standard

14.2.2.15 dot1x privateclient enable

Command: dot1x privateclient enable
no dot1x privateclient enable
Function: Enable private 802.1x messages for 802.1x client for DCS-3950 series switches. If no is put in front of the command, the private messages will be disabled.
Command mode: Global Mode.
Default: Private 802.1x messages for clients are disabled by default.
Usage Guide: To implement DCN network solution, the private 802.1x messages are a must. Or many DCN network feature can not be configured. For more detail, please refer to the DCN DCBI overall network solution. If the switch is configured to use private 802.1x messages for authentication, the standard 802.1x will not be able to connect to the switch.
Example: Enable the private 802.1x messages for the switch.
Switch(Config)#dot1x privateclient enable

14.2.2.16 dot1x re-authenticate

Command: dot1x re-authenticate [interface <interface-name>]
Function: Enable real-time 802.1x re-authentication (no wait timeout requires) for all ports or a specified port.
Parameters: *<interface-nam>* stands for port number, omitting the parameter for all ports.
Command mode: Admin Mode

Usage Guide: This command is an Admin Mode command. It makes the switch to re-authenticate the client at once without waiting for re-authentication timer timeout. This command is no longer valid after authentication.

Example: Enable real-time re-authentication on port 0/0/8.

Switch#dot1x re-authenticate interface ether 0/0/8

14.2.2.17 dot1x re-authentication

Command: dot1x re-authentication

no dot1x re-authentication

Function: Enable periodical supplicant authentication; the '**no dot1x re-authentication**' command disables this function.

Command mode: Global Mode

Default: Periodical re-authentication is disabled by default.

Usage Guide: When periodical re-authentication for supplicant is enabled, the switch will re-authenticate the supplicant at regular interval. This function is not recommended for common use.

Example: Enable the periodical re-authentication for authenticated users.

Switch(Config)#dot1x re-authentication

14.2.2.18 dot1x timeout quiet-period

Command: dot1x timeout quiet-period <seconds>

no dot1x timeout quiet-period

Function: Set time to keep silent on supplicant authentication failure; the '**no dot1x timeout quiet-period**' command restores the default value.

Parameters: <*seconds*> is the silent time for the port in seconds, the valid range is 1 to 65535.

Command mode: Global Mode

Default: The default value is 10 seconds.

Usage Guide: Default value is recommended.

Example: Set the silent time to 120 seconds.

Switch(Config)#dot1x timeout quiet-period 120

14.2.2.19 dot1x timeout re-authperiod

Command: dot1x timeout re-authperiod <seconds>

no dot1x timeout re-authperiod

Function: Set the supplicant re-authentication interval; the '**no dot1x timeout re-authperiod**' command restores the default setting.

Parameters: <*seconds*> is the interval for re-authentication, in seconds, the valid range is 1 to 65535.

Command mode: Global Mode

Default: The default value is 3600 seconds.

Usage Guide: dot1x re-authentication must be enabled first before supplicant re-authentication interval can be modified. If authentication is not enabled for the switch, the supplicant re-authentication interval set will not take effect.
Example: Set the re-authentication time to 1200 seconds.
Switch(Config)#dot1x timeout re-authperiod 1200

14.2.2.20 dot1x timeout tx-period

Command: dot1x timeout tx-period <seconds>
no dot1x timeout tx-period
Function: Set the interval for the supplicant to re-transmit EAP request/identity frame; the '**no dot1x timeout tx-period**' command restores the default setting.
Parameters: <*seconds*> is the interval for re-transmission of EAP request frames, in seconds; the valid range is 1 to 65535.
Command mode: Global Mode
Default: The default value is 30 seconds.
Usage Guide: Default value is recommended.
Example: Set the EAP request frame re-transmission interval to 1200 seconds.
Switch(Config)#dot1x timeout tx-period 1200

14.2.2.21 dot1x unicast enable

Command: dot1x unicast enable
no dot1x unicast enable
Function: Enable unicast for 802.1x authentications.
Command mode: Global Mode.
Default: The unicast for 802.1x is not enabled by default.
Usage Guide: Before configuring 802.1x authentication for any ports, 802.1x should be enabled globally, then the 802.1x unicasting should be enabled too.
Example: Enable 802.1x configuration and 802.1x unicast configuration, then enable 802.1x authentication for ethernet port 0/0/1.
Switch(Config)#dot1x enable
Switch(Config)# dot1x unicast enable
Switch(Config)#interface Ethernet 0/0/1
Switch(Config-Ethernet0/0/1)#dot1x enable

14.2.2.22 dot1x user free-resource

Command: dot1x user free-resource <*prefix*> <*mask*>
no dot1x user free-resource
Function: Set free access network resource for unauthorized dot1x user. The 'no dot1x user free-resource' command close the resource.
Parameters:
<*prefix*> is the resource IP network address in dotted decimal notation.

<mask>is the subnet mask in dotted decimal notation.

Command mode: Globle Mode.

Default: no free resource set.

Usage guide: The command is used only for dot1x port-methods user-based access management. For dot1x port-methods userbased access management, the unauthorized user can access the free-resource set by the command. For dot1x port-methods port-based and MAC-based access management, none of resource is accessible for unauthorized user.

notes: can set only one resource IP network address.

Example: Set the resource network address to be1.1.1.0 ， subnet mask to be 255.255.255.0.

Switch(Config)#dot1x user free-resource 1.1.1.0 255.255.255.0

14.2.2.23 radius-server accounting host

Command: radius-server accounting host <*ip-address*> [port <*port-number*>] [primary]

no radius-server accounting host <*ip-address*>

Function: Specify the IP address and listening port number for RADIUS accounting server; the '**no radius-server authentication host <*IPaddress*>**' command deletes the RADIUS accounting server

Parameters: <*ip-address*> stands for the server IP address; **<*port-number*>** for server listening port number from 0 to 65535; **primary** for primary server. Multiple RADIUS sever can be configured and would be available. RADIUS server will be searched by the configured order if **primary** is not configured, otherwise, the specified RADIUS server will be used first.

Command mode: Global Mode

Default: No RADIUS accounting server is configured by default.

Usage Guide: This command is used to specify the IP address and port number of the specified RADIUS server for switch accounting, multiple command instances can be configured. The **<*port-number*>** parameter is used to specify accounting port number, which must be the same as the specified accounting port in the RADIUS server; the default port number is 1813. If this port number is set to 0, accounting port number will be generated at random and can result in invalid configuration. This command can be used repeatedly to configure multiple RADIUS servers communicating with the switch, the switch will send accounting packets to all the configured accounting servers, and all the accounting servers can be backup servers for each other. If **primary** is specified, then the specified RADIUS server will be the primary server.

Example: Set the RADIUS accounting server of IP address to 100.100.100.60 as the primary server, with the accounting port number as 3000.

Switch(Config)#radius-server accounting host 100.100.100.60 port 3000 primary

14.2.2.24 radius-server authentication host

Command: radius-server authentication host <*ip-address* > [port <port-number>] [primary]
no radius-server authentication host *ip-address* >

Function: Specify the IP address and listening port number for the RADIUS server; the '**no radius-server authentication host <*IPaddress*>**' command deletes the RADIUS authentication server

Parameters: <*ip-address* > stands for the server IP address; **<*port-number*>** for listening port number, from 0 to 65535, where 0 stands for non-authentication server usage; **primary** for primary server.

Command mode: Global Mode

Default: No RADIUS authentication server is configured by default.

Default: No RADIUS authentication server is configured by default.

Usage Guide: This command is used to specify the IP address and port number of the specified RADIUS server for switch authentication, multiple command instances can be configured. The port parameter is used to specify authentication port number, which must be the same as the specified authentication port in the RADIUS server, the default port number is 1812. If this port number is set to 0, the specified server is regard as non-authenticating. This command can be used repeatedly to configure multiple RADIUS servers communicating with the switch, the configured order is used as the priority for the switch authentication server. If **primary** is specified, then the specified RADIUS server will be the primary server.

Example: Set the RADIUS authentication server address as 200.1.1.1.

```
Switch(Config)#radius-server authentication host 200.1.1.1
```

14.2.2.25 radius-server dead-time

Command: radius-server dead-time <minutes>
no radius-server dead-time

Function: Configure the restore time when RADIUS server is down; the '**no radius-server dead-time**' command restores the default setting.

Parameters: < *minute* > is the down -restore time for RADIUS server in minutes, the valid range is 1 to 255.

Command mode: Global Mode

Default: The default value is 5 minutes.

Usage Guide: This command specifies the time to wait for the RADIUS server to recover from inaccessible to accessible. When the switch acknowledges a server to be inaccessible, it marks that server as having invalid status, after the interval specified by this command; the system resets the status for that server to valid.

Example: Set the down-restore time for RADIUS server to 3 minutes.

```
Switch(Config)#radius-server dead-time 3
```

14.2.2.26 radius-server key

Command: radius-server key <string>

no radius-server key

Function: Specify the key for the RADIUS server (authentication and accounting); the 'no radius-server key' command deletes the key for RADIUS server.

Parameters: <*string*> is a key string for RADIUS server, up to 16 characters are allowed.

Command mode: Global Mode

Usage Guide: The key is used in the encrypted communication between the switch and the specified RADIUS server. The key set must be the same as the RADIUS server set, otherwise, proper RADIUS authentication and accounting will not perform properly.

Example: Set the RADIUS authentication key to be 'test'.

Switch(Config)# radius-server key test

14.2.2.27 radius-server retransmit

Command: radius-server retransmit <retries>

no radius-server retransmit

Function: Configure the re-transmission times for RADIUS authentication packets; the '**no radius-server retransmit**' command restores the default setting

Parameters: <*retries*> is a retransmission times for RADIUS server, the valid range is 0 t o 100.

Command mode: Global Mode

Default: The default value is 3 times.

Usage Guide: This command specifies the retransmission time for a packet without a RADIUS server response after the switch sends the packet to the RADIUS server. If authentication information is missing from the authentication server, AAA authentication request will need to be re-transmitted to the authentication server. If AAA request retransmission count reaches the retransmission time threshold without the server responding, the server will be considered to as not working, the switch sets the server as invalid.

Example: Set the RADIUS authentication packet retransmission time to five times.

Switch(Config)# radius-server retransmit 5

14.2.2.28 radius-server timeout

Command: radius-server timeout <seconds>

no radius-server timeout

Function: Configure the timeout timer for RADIUS server; the '**no radius-server timeout**' command restores the default setting.

Parameters: <*seconds*> is the timer value (second) for RADIUS server timeout, the valid range is 1 to 1000.

Command mode: Global Mode

Default: The default value is 3 seconds.

Usage Guide: This command specifies the interval for the switch to wait RADIUS server response. The switch waits for corresponding response packets after sending RADIUS Server request packets. If RADIUS server response is not received in the specified

waiting time, the switch resends the request packet or sets the server as invalid according to the current conditions.
Example: Set the RADIUS authentication timeout timer value to 30 seconds.
Switch(Config)# radius-server timeout 30

14.2.2.29 radius-server realtime-accounting timer

Command：radius-server realtime-accounting timer <*minute*>
Function：Set the interval of sending accounting messages. the no operation of this command will reset to the default configuration.
Parameters：***<seconds>*** is the interval of sending accounting update messages, in seconds, ranging from 60 to 3600.
Command mode：Global Mode.
Default：The default interval of sending accounting update messages is 300 seconds.
Usage Guide: None.
Example: Configure to send accounting messages every 10 minutes.
Switch(Config)# radius-server realtime-accounting timer 10

14.3 802.1x Application Example

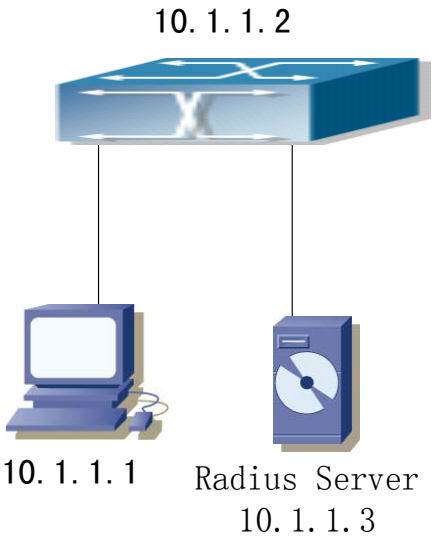


Fig 14-2 IEEE802.1x Configure Topology of the example

The computer is connected to the port 0/0/2 of the switch, and the IEEE802.1 authentication function is enabled on the port, which adopts MAC-address-based authentication as the access method by default. The IP address of the switch is 10.1.1.2, and all the ports other than port 0/0/2 are connected to RADIUS authentication server, the IP address of which is 10.1.1.3. By default the authentication and cost-counting ports are

port 1812 and port 1813. The Digital China IEEE802.1x authentication client software is installed on the computer to implement IEEE802.1x authentication。

The following is the procedure of configuration:
Switch(Config)#interface vlan 1↵
Switch(Config-if-vlan1)#ip address 10.1.1.2 255.255.255.0↵
Switch(Config-if-vlan1)#exit↵
Switch(Config)#radius-server authentication host 10.1.1.3↵
Switch(Config)#radius-server accounting host 10.1.1.3↵
Switch(Config)#radius-server key test↵
Switch(Config)#aaa enable↵
Switch(Config)#aaa-accounting enable↵
Switch(Config)#dot1x enable↵
Switch(Config)#interface ethernet 0/0/2↵
Switch(Config-Ethernet0/0/2)#dot1x enable↵
Switch(Config-Ethernet0/0/2)#dot1x port-method macbased↵
Switch(Config-Ethernet0/0/2)#dot1x port-control auto↵
Switch(Config-Ethernet0/0/2)#exit

14.4 802.1x Troubleshooting

14.4.1 802.1x Monitor and debug Command List

14.4.1.1 show aaa config

Command: show aaa config
Function: Display the configured commands for the switch as a RADIUS client.
Command mode: Admin Mode
Usage Guide: Displays whether AAA authentication, accounting are enabled and information for key, authentication and accounting server specified.
Example:
Switch#show aaa config（For Boolean value, 1 stands for TRUE and 0 for FALSE）

---------- AAA config data ----------

Is Aaa Enabled = 1
Is Account Enabled= 1
MD5 Server Key = aa
authentication server sum = 2
authentication server[0].Host IP = 30.1.1.30
.Udp Port = 1812
.Is Primary = 1

```
                                    .Is Server Dead = 0
                                    .Socket No = 0
    authentication server[1].Host IP = 192.168.1.218
                                    .Udp Port = 1812
                                    .Is Primary = 0
                                    .Is Server Dead = 0
                                    .Socket No = 0
    accounting server sum = 2
    accounting server[0].Host IP = 30.1.1.30
                                     .Udp Port = 1813
                                     .Is Primary = 1
                                     .Is Server Dead = 0
                                     .Socket No = 0
    accounting server[1].Host IP = 192.168.1.218
                                     .Udp Port = 1813
                                     .Is Primary = 0
                                     .Is Server Dead = 0
                                     .Socket No = 0
    Time Out = 3
    Retransmit = 3
    Dead Time = 5
Account Time Interval = 0
```

Displayed information	Description
Is Aaa Enabled	Indicates whether AAA authentication is enabled or not. 1 for enable and 0 for disable.
Is Account Enabled	Indicates whether AAA accounting is enabled or not. 1 for enable and 0 for disable.
MD5 Server Key	Displays the key for RADIUS server.
authentication server sum	The number of authentication servers.
authentication server[X].Host IP .Udp Port .Is Primary .Is Server Dead .Socket No	Displays the authentication server number and corresponding IP address, UDP port number, Primary server or not, down or not, and socket number.
accounting server sum	The number of accounting servers.
accounting server[X].Host IP .Udp Port .Is Primary .Is Server Dead .Socket No	Displays the accounting server number and corresponding IP address, UDP port number, Primary server or not, down or not, and socket number.
Time Out	Displays the timeout value for RADIUS

	server.
Retransmit	Displays the retransmission times for RADIUS server authentication packets.
Dead Time	Displays the down-restoration time for RADIUS server.
Account Time Interval	Displays accounting time interval.

14.4.1.2 show aaa authenticated-user

Command: show aaa authenticated-user
Function: Display the authenticated users online.
Command mode: Admin Mode
Usage Guide: Usually the administrator is concerned only with the online user information, the other information displayed is used for troubleshooting by technical support.
Example:
Switch#show aaa authenticated-user

---------- authenticated users ----------
UserName Retry RadID Port EapID ChapID OnTime UserIP MAC
---
bb 0 255 38 1 0 22 192.168.5.118 00-0b-cd-47-6f-30

---------- total: 1 ----------

14.4.1.3 show aaa authenticating-user

Command: show aaa authenticating-user
Function: Display the authenticating users.
Command mode: Admin Mode
Usage Guide: Usually the administrator concerns only information about the authenticating user , the other information displays is used for troubleshooting by the technical support.
Example:
Switch#show aaa authenticating-user
---------- authenticating users ----------
User-name Retry-time Radius-ID Port Eap-ID Chap-ID Mem-Addr State
---
bb 0 4 2 1 0 16652824 ACCOUNT_STARTING
---------- total: 1 ----------

14.4.1.4 show radius count

Command: show radius {authencated-user|authencating-user} count
Function: Display the statistics for users of RADIUS authentication.

Parameters: **authencated-user** displays the authenticated users online;
authencating-user displays the authenticating users.
Command mode: Admin Mode
Usage Guide: The statistics for RADIUS authentication users can be displayed with the 'show radius count' command.
Example:
1. Display the statistics for RADIUS authenticated users.
Switch #show radius authencated-user count
The authencated online user num is: 1
2. Display the statistics for RADIUS authenticating users and others.
Switch#show radius authencating-user count
The authencating user num is: 1

14.4.1.5 show dot1x

Command: show dot1x [interface <interface-list>]
Function: Display dot1x parameter related information, if parameter information is added, corresponding dot1x status for corresponding port is displayed.
Parameters: <*interface-list*> is the port list. If no parameter is specified, information for all ports is displayed.
Command mode: Admin Mode
Usage Guide: Enabling dot1x debug information allows the check of dot1x protocol negotiation process and is helpful in troubleshooting.
Example:
1. Display information about dot1x global parameter for the switch.
Switch#show dot1x
Global 802.1X Parameters
free resource :unknown
reauth-enabled :yes
reauth-period :3600
quiet-period :10
tx-period :30
max-req :2
authenticator mode :active

Mac Filter Disable
MacAccessList :
dot1x-EAPoR Enable
dot1x-privateclient Enable
dot1x-unicast Disable

802.1X is enabled on ethernet Ethernet0/0/8
Authentication Method:User based advanced
Max User Number:10

Notify DCBI is 0

Displayed information	Explanation
Global 802.1x Parameters	Global 802.1x parameter information
free-resource	Free resource
reauth-enabled	Whether re-authentication is enabled or not
reauth-period	Re-authentication interval
quiet-period	Silent interval
tx-period	EAP retransmission interval
max-req	EAP packet retransmission interval
authenticator mode	Switch authentication mode
Mac Filter	Enables dot1x address filter or not
MacAccessList :	Dot1x address filter table
dot1x-EAPoR	Authentication method used by the switch (EAP relay, EAP local end)
dot1x-privateclient	Whether enable private client
dot1x-unicast	Whether enable unicast
802.1x is enabled on ethernet 0/0/8	Indicates whether dot1x is enabled for the port
Authentication Method:	Port authentication method (MAC-based, port-based)
Status	Port authentication status
Port-control	Port authorization status
Supplicant	Authenticator MAC address
Max User Number	Max user number of the port
Notify DCBI	Whether has successfully notificated DCBI server or not.

14.4.1.6 debug aaa error

Command：debug aaa error
no debug aaa error

Function： Enable the debug error information of aaa; the 'n **no debug aaa error**' command is used to disable the debug error information of aaa.

Command mode： Admin Mode

Parameters：None

Usage Guide: None.

Example: Enable debugging for aaa error events.

Switch#debug aaa error

14.4.1.7 debug aaa packet

Command: debug aaa packet {send|receive|all} interface {[ethernet] *<InterfaceName>*}

no debug aaa packet {send|receive|all} interface {[ethernet] *<InterfaceName>*}

Function：Enable the information on receiving/sending packets of aaa; the 'no debug aaa packet {send|receive|all} interface {[ethernet] <InterfaceName>}' command is used to disable the information on receiving/sending packets of aaa.

Command mode：Admin Mode

Parameters：**send** represents sending packets; **receive**represents receiving packets；**all** represents receiving and sending packets；***<InterfaceName>*** is the name of interface.

Usage Guide: None.

Example: Enable debugging aaa packets for ethernet interface 0/0/1.

Switch#debug aaa packet receive interface ethernet 0/0/1

14.4.1.8 debug aaa detail

Command：**debug dot1x detail {pkt-send|pkt-receive|internal|userbased|all} interface {[ethernet] *<InterfaceName>*}**

no debug dot1x detail {pkt-send|pkt-receive|internal|userbased|all} interface {[ethernet] *<InterfaceName>*}

Function：Enable the detail debug information of dot1x；the ' no debug dot1x detail {connection | event | attribute interface {[ethernet] <InterfaceName>}}' command is tgo disable the detail debug information of dot1x.

Command mode：Admin Mode

Parameters：**pkt-send** represents the detail of sending packets；**pkt-receive** represen the details of receiving packets；**internal** represents internal details；**userbased** represents the user-based information；**all** represents all the detailed informations；***<InterfaceName>*** is the name of interface.

Usage Guide: None.

Example: Enable detail debugging for AAA.

Switch#debug aaa detail connection

14.4.1.9 debug dot1x error

Command：**debug dot1x error**

no debug dot1x error

Function：Enable the information on debug error of dot1x;the '**no debug dot1x error** ' disable the information on debug error of dot1x.

Parameters：None

Usage Guide: None.

Example: Enable debugging for dot1x error events.

Switch#debug dot1x error

14.4.1.10 debug dot1x packet

Command：**debug dot1x packet {send|receive|all} interface {[ethernet]**

<InterfaceName>}

no debug dot1x packet {send|receive|all} interface {[ethernet] *<InterfaceName>}*

Function：Enable the information on receiving/sending packets of dot1x; the ‘ no debug dot1x packet {send|receive|all} interface {[ethernet] <InterfaceName>} ‘ command is to disable the information on receiving/sending packets of dot1x.

Command mode：Admin Mode

Parameters：Send represents sending packets; **receive**represents receiving packets；**all** represents receiving and sending packets；***<InterfaceName>*** is the name of interface.

Usage Guide: None.

Example: Enable debugging for dot1x packets for ethernet interface 0/.0.1.

Switch#debug dot1x packet receive interface ethernet 0/0/1

14.4.1.11 debug dot1x detail

Command：**debug dot1x detail {pkt-send|pkt-receive|internal|userbased|all} interface {[ethernet] *<InterfaceName>}***

no debug dot1x detail {pkt-send|pkt-receive|internal|userbased|all} interface {[ethernet] *<InterfaceName>}*

Function：Enable the detail debug information of dot1x；the ‘ no debug dot1x detail {connection | event | attribute interface {[ethernet] <InterfaceName>}}’ command is tgo disable the detail debug information of dot1x.

Command mode：Admin Mode

Parameters：**pkt-send** represents the detail of sending packets；**pkt-receive** represen the details of receiving packets；**internal** represents internal details；**userbased** represents the user-based information；**all** represents all the detailed informations；***<InterfaceName>*** is the name of interface.

Usage Guide: None.

Example: Enable detail debugging for dot1x packets.

Switch#debug dot1x detail pkt-receive interface 0/0/1

14.4.1.12 debug dot1x fsm

Command：**debug dot1x fsm {asm|aksm|ratsm|basm|all} interface {[ethernet] *<InterfaceName>}***

no debug dot1x fsm {asm|aksm|ratsm|basm|all} interface {[ethernet] *<InterfaceName>}*

Function：Enable the limited state machine debug information of dot1x; the ‘no debug dot1x fsm {asm|aksm|ratsm|basm|all} interface {[ethernet] <InterfaceName>} ‘ command is to disable the limited state machine debug information of dot1x

Command mode：Admin Mode

Parameters：**asm** represents the authenticator state machine information；**aksm** represents the authenticator key transmission state machine state；**ratsm** represents reauthentication timer state machine information；**basm** represents background

authentication state machine information；**all** represents all the state machine information；***<InterfaceName>*** is the name of interface.
Usage Guide: None.
Example: Enable debugging for dot1x state machines.
Switch#debug dot1x fsm asm interface 0/0/1

14.4.2 802.1x Troubleshooting

It is possible that 802.1x be congfigured on ports and 802.1x authentication be setted to auto, but switch cann't be to authenticated state after the user runs 802.1x supplicant software. Here are some possible causes and solutions:

- If 802.1x cannot be enabled for a port, make sure the port is not executing Spanning tree, or MAC binding, or configured as a Trunk port or for port aggregation. To enable the 802.1x authentication, the above functions must be disabled.
- If the switch is configured properly but still cannot pass through authentication, connectivity between the switch and RADIUS server, the switch and 802.1x client should be verified, and the port and VLAN configuration for the switch should be checked, too.
- Check the event log in the RADIUS server for possible causes. In the event log, not only unsuccessful logins are recorded, but prompts for the causes of unsuccessful login. If the event log indicates wrong authenticator password, radius-server key parameter shall be modified; if the event log indicates no such authenticator, the authenticator needs to be added to the RADIUS server; if the event log indicates no such login user, the user login ID and password may be wrong and should be verified and input again.
- If the access mode of a port is userbased advanced and static user is configured on RADIUS server but is not issued to the switch, first check whether the RADIUS server is configured correctly using the command'ip user helper addres', and then check whether the RADIUS server configured static user on the port, last check the issueing of static user using the command' show dot1x interface'

Chapter 15 ACL Configuration

15.1 Introduction to ACL

ACL (Access Control List) is an IP packet filtering mechanism employed in switches, providing network traffic control by granting or denying access through the switches, effectively safeguarding the security of networks. The user can lay down a set of rules according to some information specific to packets, each rule describes the action for a packet with certain information matched: ‘permit’ or ‘deny’. The user can apply such rules to the incoming or outgoing direction of switch ports, so that data streams in the specific direction of specified ports must comply with the ACL rules assigned.

15.2 Access-list

Access-list is a sequential collection of conditions that corresponds to a specific rule. Each rule consists of filter information and the action when the rule is matched. Information included in a rule is the effective combination of conditions such as source IP, destination IP, IP protocol number and TCP port. Access-lists can be categorized by the following criteria:

- Filter information based criterion: IP access-list (layer 3 or higher information), MAC access-list (layer 2 information), and MAC-IP access-list (layer 2 or layer 3 or higher).
- Configuration complexity based criterion: standard and extended, the extended mode allows more specific filtering of information.
- Nomenclature based criterion: numbered and named

Description of an ACL should cover the above three aspects.

15.2.1 Access-group

When a set of access-lists are created, they can be applied to traffic of any direction on all ports. Access-group is the description to the binding of an access-list to the specified direction on a specific port. When an access-group is created, all packets from in the specified direction through the port will be compared to the access-list rule to decide whether to permit or deny access.

15.2.2 Access-list Action and Global Default Action

There are two access-list actions and default actions: ‘permit’ or ‘deny’

The following rules apply:

- An access-list can consist of several rules. Filtering of packets compares packet conditions to the rules, from the first rule to the first matched rule; the rest of the rules will not be processed.
- Global default action applies only to IP packets in the incoming direction on the ports. For non- incoming IP packets and all outgoing packets, the default forward action is ‘permit’.
- Global default action applies only when packet flirter is enabled on a port and no ACL is bound to that port, or no binding ACL matches.
- When an access-list is bound to the outgoing direction of a port, the action in the rule can only be ‘deny’.

15.3 ACL Configuration

15.3.1 ACL Configuration Task List

1. Configuring access-list
   - （1） Configuring a numbered standard IP access-list
   - （2） Configuring a numbered extended IP access-list
   - （3） Configuring a standard IP access-list based on nomenclature
     a) Create a standard IP access-list based on nomenclature
     b) Specify multiple ‘permit’ or ‘deny’ rule entries.
     c) Exit ACL Configuration Mode
   - （4） Configuring an extended IP access-list based on nomenclature.
     a) Create an extensive IP access-list based on nomenclature
     b) Specify multiple ‘permit’ or ‘deny’ rule entries.
     c) Exit ACL Configuration Mode
   - （5） Configuring a numbered standard MAC access-list
   - （6） Configuring a numbered extended MAC access-list
   - （7） Configuring a standard MAC access-list based on nomenclature
     a) Create a standard IP access-list based on nomenclature
     b) Specify multiple ‘permit’ or ‘deny’ rule entries.
     c) Exit ACL Configuration Mode
   - （8） Configuring a numbered extended MAC-IP access-list
   - （9） Configuring a standard MAC-IP access-list based on nomenclature
     a) Create a standard MAC-IP access-list based on nomenclature
     b) Specify multiple ‘permit’ or ‘deny’ rule entries.

c) Exit MAC-IP Configuration Mode

2. Configuring the packet filtering function
   (1) Enable global packet filtering function
   (2) Configure default action.
3. Configuring time range function
   (1) Create the name of the time range
   (2) Configure periodic time range
   (3) Configure absolute time range
4. Bind access-list to a specific direction of the specified port.

1. Configuring access-list

（1）Configuring a numbered standard IP access-list

Command	**Explanation**
Global Mode	
access-list <*num*> {deny | permit} {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} **no access-list <*num*>**	Creates a numbered standard IP access-list, if the access-list already exists, then a rule will add to the current access-list; the '**no access-list <*num*>**' command deletes a numbered standard IP access-list.

（2）Configuring a numbered extensive IP access-list

Command	**Explanation**
Global Mode	
access-list <*num*> {deny | permit} icmp {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} {{<*dIpAddr*> <*dMask*>} | any-destination | {host-destination <*dIpAddr*>}} [<*icmp-type*> [<*icmp-code*>]] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates a numbered ICMP extended IP access rule; if the numbered extended access-list of specified number does not exist, then an access-list will be created using this number.
access-list <*num*> {deny | permit} igmp {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} {{<*dIpAddr*> <*dMask*>} | any-destination | {host-destination <*dIpAddr*>}} [<*igmp-type*>] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates a numbered IGMP extended IP access rule; if the numbered extended access-list of specified number does not exist, then an access-list will be created using this number.

access-list <*num*> {deny | permit} tcp {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} [s-port <*sPort*>] {{<*dIpAddr*> <*dMask*>} | any-destination | {host-destination <*dIpAddr*>}} [d-port <*dPort*>] [ack+fin+psh+rst+urg+syn] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates a numbered TCP extended IP access rule; if the numbered extended access-list of specified number does not exist, then an access-list will be created using this number.
access-list <*num*> {deny | permit} udp {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} [s-port <*sPort*>] {{<*dIpAddr*> <*dMask*>} | any-destination | {host-destination <*dIpAddr*>}} [d-port <*dPort*>] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates a numbered UDP extended IP access rule; if the numbered extended access-list of specified number does not exist, then an access-list will be created using this number.
access-list <*num*> {deny | permit} {eigrp | gre | igrp | ipinip | ip | <*int*>} {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} {{<*dIpAddr*> <*dMask*>} | any-destination | {host-destination <*dIpAddr*>}} [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates a numbered IP extended IP access rule for other specific IP protocol or all IP protocols; if the numbered extended access-list of specified number does not exist, then an access-list will be created using this number.
no access-list <*num*>	Deletes a numbered extensive IP access-list

（3）Configuring a standard IP access-list basing on nomenclature

a. Create a name-based standard IP access-list

Command	**Explanation**
Global Mode	
ip access-list standard <*name*> **no ip access-list standard <*name*>**	Creates a standard IP access-list based on nomenclature; the '**no ip access-list standard <*name*>** ' command delete the name-based standard IP access-list

b. Specify multiple 'permit' or 'deny' rules

Command	**Explanation**
Standard IP ACL Mode	
[no] {deny | permit} {{<*sIpAddr*> <*sMask* >} | any-source | {host-source <*sIpAddr*>}}	Creates a standard name-based IP access rule; the '**no**' form command deletes the name-based standard IP access rule

c. Exit name-based standard IP ACL configuration mode

Command	Explanation
Standard IP ACL Mode	
Exit	Exits name-based standard IP ACL configuration mode

（4）Configuring an name-based extended IP access-list

a. Create an extended IP access-list basing on nomenclature

Command	Explanation
Global Mode	
ip access-list extended <*name*> **no ip access-list extended <*name*>**	Creates an extended IP access-list basing on nomenclature; the '**no ip access-list extended <*name*>**' command deletes the name-based extended IP access-list

b. Specify multiple 'permit' or 'deny' rules

Command	Explanation
Extended IP ACL Mode	
[no] {deny | permit} icmp {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} {{<*dIpAddr*> <*dMask*>} | any-destination | {host-destination <*dIpAddr*>}} [<*icmp-type*> [<*icmp-code*>]] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates an extended name-based ICMP IP access rule; the '**no**' form command deletes this name-based extended IP access rule
[no] {deny | permit} igmp {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} {{<*dIpAddr*> <*dMask*>} | any-destination | {host-destination <*dIpAddr*>}} [<*igmp-type*>] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates an extended name-based IGMP IP access rule; the '**no**' form command deletes this name-based extended IP access rule
[no] {deny | permit} tcp {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} [s-port <*sPort*>] {{<*dIpAddr*> <*dMask*>} | any-destination | {host-destination <*dIpAddr*>}} [d-port <*dPort*>] [ack+fin+psh+rst+urg+syn] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates an extended name-based TCP IP access rule; the '**no**' form command deletes this name-based extended IP access rule

[no] {deny | permit} udp {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} [sPort <*s-port*>] {{<*dIpAddr*> <*dMask*>} | any-destination | {host-destination <*dIpAddr*>}} [d-port <*dPort*>] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates an extended name-based UDP IP access rule; the '**no**' form command deletes this name-based extended IP access rule
[no] {deny | permit} {eigrp | gre | igrp | ipinip | ip | <*int*>} {{<*sIpAddr*> <*sMask*>} | any-source | {host-source <*sIpAddr*>}} {{<*dIpAddr*> <*dMask*>} | any-destination | {host-destination <*dIpAddr*>}} [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates an extended name-based IP access rule for other IP protocols; the '**no**' form command deletes this name-based extended IP access rule

c. Exit extended IP ACL configuration mode

Command	**Explanation**
Extended IP ACL Mode	
Exit	Exits extended name-based IP ACL configuration mode

（5） Configuring a numbered standard MAC access-list

Command	**Explanation**
Global Mode	
access-list <*num*> {deny|permit} {any-source-mac|{host-source-mac <*host_smac*>}|{<*smac*><*smac-mask*>}} **no access-list <*num*>**	Creates a numbered standard MAC access-list, if the access-list already exists, then a rule will add to the current access-list; the '**no access-list <*num*>**' command deletes a numbered standard MAC access-list.

（6） Creates a numbered MAC extended access-list

Command	**Explanation**
Global Mode	

access-list <*num*> {deny|permit} {any-source-mac| {host-source-mac<*host_smac*>}|{<*smac*><*smac-mask*>}}{any-destination-mac|{host-destination-mac <*host_dmac*>}|{<*dmac*><*dmac-mask*>}}[{untagged-eth2|tagged-eth2|untagged-802.3|tagged-802.3} [<*offset1*> <*length1*> <*value1*> [<*offset2*> <*length2*> <*value2*> [<*offset3*> <*length3*> <*value3*> [<*offset4*> <*length4*> <*value4*>]]]]] **no access-list <*num*>**	Creates a numbered MAC extended access-list, if the access-list already exists, then a rule will add to the current access-list; the '**no access-list <*num*>**' command deletes a numbered MAC extended access-list.

（7） Configuring a extended MAC access-list based on nomenclature

a. Create a extended MAC access-list based on nomenclature

Command	**Explanation**
Global Mode	
mac-access-list extended <*name*> **no mac-access-list extended <*name*>**	Creates an extended name-based MAC access list; the '**no**' form command deletes this name-based extended MAC access list

b. Specify multiple 'permit' or 'deny' rule entries

Command	**Explanation**
Extended name-based MAC access rule Mode	
[no]{deny|permit}{any-source-mac|{host-source-mac <*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac <*host_dmac*>} |{<*dmac*> <*dmac-mask*>}} [cos <*cos-val*> [<*cos-bitmask*>]] [vlanId <*vid-value*> [<*vid-mask*>]] [ethertype <*protocol*> [<*protocol-mask*>]]	Creates an extended name-based MAC access rule matching MAC frame; the '**no**' form command deletes this name-based extended MAC access rule
[no]{deny|permit}{any-source-mac|{host-source-mac<*host_smac*>}|{<*smac*> <*smac-mask*>}}{any-destination-mac|{host-destination-mac<*host_dmac*>}|{<*dmac*><*dmac-mask*>}} [untagged-eth2 [ethertype <*protocol*> [protocol-mask]]]	Creates an extended name-based MAC access rule matching untagged ethernet 2 frame; the '**no**' form command deletes this name-based extended MAC access rule

[no]{deny|permit}{any-source-mac|{host-source-mac <*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac <*host_dmac*>}|{<*dmac*><*dmac-mask*>}} [untagged-802.3]	Creates an MAC access rule matching 802.3 frame; the '**no**' form command deletes this MAC access rule
[no]{deny|permit}{any-source-mac|{host-source-mac<*host_smac*>}|{<*smac*><*smac-mask*>}}{any-destination-mac|{host-destination-mac<*host_dmac*>}|{<*dmac*><*dmac-mask*>}}[tagged-eth2 [cos <*cos-val*> [<*cos-bitmask*>]] [vlanId <*vid-value*> [<*vid-mask*>]] [ethertype<*protocol*> [<*protocol-mask*>]]]	Creates an MAC access rule matching tagged ethernet 2 frame; the '**no**' form command deletes this MAC access rule
[no]{deny|permit}{any-source-mac|{host-source-mac <*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac<*host_dmac*>}|{<*dmac*><*dmac-mask*>}} [tagged-802.3 [cos <*cos-val*> [<*cos-bitmask*>]] [vlanId <*vid-value*> [<*vid-mask*>]]]	Creates an MAC access rule matching tagged 802.3 frame;the '**no**' form command deletes this MAC access rule

c. Exit ACL Configuration Mode

Command	**Explanation**
Extended name-based MAC access configure Mode	
Exit	Quit the extended name-based MAC access configure mode

（8）Configuring a numbered extended MAC-IP access-list

Command	**Explanation**
Global mode	

access-list<*num*>{deny|permit}{any-source-mac| {host-source-mac<*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac <*host_dmac*>}|{<*dmac*><*dmac-mask*>}} }icmp {{<*source*><*source-wildcard*>}|any-source| {host-source<*source-host-ip*>}} {{<*destination*><*destination-wildcard*>}|any-destination| {host-destination<*destination-host-ip*>}}[<*icmp-type*> *[*<*icmp-code*>]] [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates a numbered mac-icmp extended mac-ip access rule; if the numbered extended access-list of specified number does not exist, then an access-list will be created using this number.
access-list<*num*>{deny|permit}{any-source-mac| {host-source-mac<*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac <*host_dmac*>}|{<*dmac*><*dmac-mask*>}} }igmp {{<*source*><*source-wildcard*>}|any-source| {host-source<*source-host-ip*>}} {{<*destination*><*destination-wildcard*>}|any-destination| {host-destination<*destination-host-ip*>}} [<*igmp-type*>] [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates a numbered mac-igmp extended mac-ip access rule; if the numbered extended access-list of specified number does not exist, then an access-list will be created using this number.

access-list<num>{deny|permit}{any-source-mac| {host-source-mac<host_smac>}|{<smac><smac-mask>}}{any-destination-mac|{host-destination-mac <host_dmac>}|{<dmac><dmac-mask>}}tcp {{<source><source-wildcard>}|any-source| {host-source<source-host-ip>}}[s-port <port1>] {{<destination><destination-wildcard>}|any-destination| {host-destination <destination-host-ip>}} [d-port <port3>] [ack+fin+psh+rst+urg+syn] [precedence <precedence>] [tos <tos>][time-range<*time-range-name*>]	Creates a numbered extended mac-tcp access rule for other specific mac-tcp protocol or all mac-tcp protocols; if the numbered extended access-list of specified number
access-list<*num*>{deny|permit}{any-source-mac| {host-source-mac<*host_smac*>}|{<*smac*><*smac-mask*>}}{any-destination-mac|{host-destination-mac <*host_dmac*>}|{<*dmac*><*dmac-mask*>}}udp {{<*source*><*source-wildcard*>}|any-source| {host-source<*source-host-ip*>}}[s-port <*port1*>] {{<*destination*><*destination-wildcard*>}|any-destination| {host-destination<*destination-host-ip*>}} [d-port <*port3*>] [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates a numbered extended mac-ip access rule for other specific mac-ip protocol or all mac-ip protocols; if the numbered extended access-list of specified number does not exist, then an access-list will be created using this number.

access-list<*num*>{deny|permit}{any-source-mac| {host-source-mac<*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac <*host_dmac*>}|{<*dmac*><*dmac-mask*>}} {eigrp|gre|igrp|ip|ipinip|ospf|{<*protocol-num*>}} {{<*source*><*source-wildcard*>}|any-source| {host-source<*source-host-ip*>}} {{<*destination*><*destination-wildcard*>}|any-destination| {host-destination<*destination-host-ip*>}} [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates a numbered extended mac-ip access rule for other specific mac-ip protocol or all mac-ip protocols; if the numbered extended access-list of specified number does not exist, then an access-list will be created using this number.
no access-list <*num*>	Deletes this nunbered extended MAC-IP access rule

9）Configuring a extended MAC-IP access-list based on nomenclature

a) Create a extended MAC-IP access-list based on nomenclature

Command	**Explanation**
Global Mode	
mac-ip-access-list extended <*name*> **no mac-ip-access-list extended <*name*>**	Creates an extended name-based MAC-IP access rule; the '**no**' form command deletes this name-based extended MAC-IP access rule

b) Specify multiple 'permit' or 'deny' rule entries

Command	**Explanation**
Extended name-based MAC-IP access Mode	

[no] {deny|permit} {any-source-mac|{host-source-mac <*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac <*host_dmac*>}|{<*dmac*><*dmac-mask*>}}icmp {{<*source*><*source-wildcard*>}|any-source| {host-source<*source-host-ip*>}} {{<*destination*><*destination-wildcard*>}|any-destination| {host-destination <*destination-host-ip*>}} [<*icmp-type*> [<*icmp-code*>]] [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates an extended name-based MAC-ICMP access rule; the '**no**' form command deletes this name-based extended MAC-ICMP access rule
[no]{deny|permit}{any-source-mac|{host-source-mac <*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac <*host_dmac*>}|{<*dmac*><*dmac-mask*>}}igmp {{<*source*><*source-wildcard*>}|any-source| {host-source<*source-host-ip*>}} {{<*destination*><*destination-wildcard*>}|any-destination| {host-destination <*destination-host-ip*>}} [<*igmp-type*>] [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates an extended name-based MAC-IGMP access rule; the '**no**' form command deletes this name-based extended MAC-IGMP access rule

[no]{deny|permit}{any-source-mac|{host-source-mac <host_smac>}|{<smac><smac-mask>}} {any-destination-mac|{host-destination-mac <host_dmac>}|{<dmac><dmac-mask>}}tcp {{<source><source-wildcard>}|any-source| {host-source<source-host-ip>}}[s-port <port1>] {{<destination><destination-wildcard>}|any-destination| {host-destination <destination-host-ip>}} [d-port <port3>] [ack+fin+psh+rst+urg+syn] [precedence <precedence>] [tos <tos>][time-range<*time-range-name*>]	Creates an extended name-based MAC-TCP access rule; the '**no**' form command deletes this name-based extended MAC-TCP access rule
[no]{deny|permit}{any-source-mac|{host-source-mac <*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac <*host_dmac*>}|{<*dmac*><*dmac-mask*>}}udp {{<*source*><*source-wildcard*>}|any-source| {host-source<*source-host-ip*>}}[s-port <*port1*>] {{<*destination*><*destination-wildcard*>}|any-destination| {host-destination <*destination-host-ip*>}} [d-port <*port3*>] [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates an extended name-based MAC-UDP access rule; the '**no**' form command deletes this name-based extended MAC-UDP access rule

[no]{deny|permit}{any-source-mac|{host-source-mac <*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac <*host_dmac*>}|{<*dmac*><*dmac-mask*>}} {eigrp|gre|igrp|ip|ipinip|ospf|{<*protocol-num*>}} {{<*source*><*source-wildcard*>}|any-source| {host-source<*source-host-ip*>}} {{<*destination*><*destination-wildcard*>}|any-destination| {host-destination<*destination-host-ip*>}} [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]	Creates an extended name-based mac-ip access rule for the other IP protocol; the '**no**' form command deletes this name-based mac-ip extended access rule

c) Exit MAC-IP Configuration Mode

Command	**Explanation**
Extended name-based MAC-IP access Mode	
Exit	Quit extended name-based MAC-IP access mode

2. Configuring packet filtering function

（1）Enable global packet filtering function

Command	**Explanation**
Global Mode	
Firewall enable	Enables global packet filtering function
Firewall disable	disables global packet filtering function

（2）Configure default action

Command	**Explanation**
Global Mode	
Firewall default permit	Sets default action to 'permit'
Firewall default deny	Sets default action to 'deny'

3. Configuring time range function

（1）Create the name of the time range

Command	**Explanation**

Global Mode	
time-range <*time_range_name*>	Create a time range named *time_range_name*
no time-range <*time_range_name*>	Stop the time range function named ***time_range_name***

（2）Configure periodic time range

Command	**Explanation**
Time range Mode	
absolute-periodic{Monday|Tuesday|Wednesday|Thursday|Friday|Saturday|Sunday}<*start_time*>to {Monday|Tuesday|Wednesday|Thursday|Friday|Saturday|Sunday} <*end_time*>	Configure the time range for the request of the week,and every week will run by the time range
periodic{{Monday+Tuesday+Wednesday+Thursday+Friday+Saturday+Sunday}| daily| weekdays | weekend} <*start_time*> to <*end_time*>	
[no]absolute-periodic{Monday|Tuesday|Wednesday|Thursday|Friday|Saturday|Sunday}<*start_time*>to{Monday|Tuesday|Wednesday|Thursday|Friday|Saturday| Sunday} <*end_time*>	stop the function of the time range in the week
[no]periodic{{Monday+Tuesday+Wednesday+Thursday+Friday+Saturday+Sunday}|daily|weekdays| weekend} <*start_time*> to <*end_time*>	

（3）Configure absolute time range

Command	**Explanation**
Global Mode	
Absolute start<*start_time*><*start_data*>[end<*end_time*> <*end_data*>]	Configure absolute time range
[no]absolute start<*start_time*><*start_data*>[end<*end_time*><*end_data*>]	stop the function of the time range

4. Bind access-list to a specific direction of the specified port

Command	**Explanation**
Physical Interface Mode, VLAN interface Mode	

{ip|mac|mac-ip} access-group <*acl-name*> {in|out} **no {ip|mac|mac-ip} access-group <*acl-name*> {in|out}**	Applies an access-list to the specified direction on the port; the '**no {ip|mac|mac-ip} access-group <*acl-name*> {in|out}**' command deletes the access-list bound to the port.

5. Clear the filtering information of the specificed port

Command	Notes
Admin Mode	
clear access-group statistic [ethernet<*interface-name*>]	Clear statistics of the specified interface.

15.3.2 ACLCommand List

15.3.2.1 access-list(ip extended)

Command: access-list <*num*> {deny|permit} icmp {{<*sIpAddr*> <*sMask*>}|any-source| {host-source <*sIpAddr*>}} {{<*dIpAddr*> <*dMask*>}|any-destination| {host-destination <*dIpAddr*>}} [<*icmp-type*> [<*icmp-code*>]] [precedence <*prec*>] [tos <*tos*>] [time-range <*time-range-name*>]
access-list <*num*> {deny|permit} igmp {{<*sIpAddr*> <*sMask*>}|any-source| {host-source <*sIpAddr*>}} {{<*dIpAddr*> <*dMask*>}|any-destination| {host-destination <*dIpAddr*>}} [<*igmp-type*>] [precedence <*prec*>] [tos <*tos*>] [time-range <*time-range-name*>]
access-list <*num*> {deny|permit} tcp {{<*sIpAddr*> <*sMask*>}|any-source| {host-source <*sIpAddr*>}} [s-port <*sPort*>] {{<*dIpAddr*> <*dMask*>}|any-destination| {host-destination <*dIpAddr*>}} [d-port <*dPort*>] [ack+ fin+ psh+ rst+ urg+ syn] [precedence <*prec*>] [tos <*tos*>] [time-range <*time-range-name*>]
access-list <*num*> {deny|permit} udp {{<*sIpAddr*> <*sMask*>}|any-source| {host-source <*sIpAddr*>}} [s-port <*sPort*>] {{<*dIpAddr*> <*dMask*>}|any-destination| {host-destination <*dIpAddr*>}} [d-port <*dPort*>] [precedence <*prec*>] [tos <*tos*>] [time-range <*time-range-name*>]
access-list <*num*> {deny|permit} {eigrp|gre|igrp|ipinip|ip|<*int*>} {{<*sIpAddr*> <*sMask*>}|any-source|{host-source <*sIpAddr*>}} {{<*dIpAddr*> <*dMask*>}| any-destination|{host-destination <*dIpAddr*>}} [precedence <*prec*>] [tos <*tos*>] [time-range <*time-range-name*>]
no access-list <*num*>

Functions: Create a numeric expansion IP access rule to match specific IP protocol or all IP protocol; if access-list of this coded numeric expansion does not exist, thus to create

such a access-list.

Parameters: <*num*> is the No. of access-list, 100-199; **<*protocol*> is the No. of upper-layer protocol of ip, 0-255; <*sIpAddr*>** is the source IP address, the format is dotted decimal notation; **<*sMask* >** is the reverse mask of source IP, the format is dotted decimal notation; **<*dIpAddr*>** is the destination IP address, the format is dotted decimal notation; **<*dMask*>** is the reverse mask of destination IP, the format is dotted decimal notation, attentive position o, ignored position 1; **<*igmp-type*>**, the type of igmp, 0-15; **<*icmp-type*>**, the type of icmp, 0-255 ; **<icmp-code>,** protocol No. of icmp, 0-255; **<prec>**, IP priority, 0-7; **<*tos*>**, to value, 0-15; **<*sPort*>**, source port No., 0-65535; **<*dPort*>**, destination port No. 0-65535;

<*time-range-name*>, name of time-range.

Command Mode: Global mode

Default: No access-lists configured.

Usage Guide: When the user assign specific **<*num*>** for the first time, ACL of the serial number is created, then the lists are added into this ACL.

Example: Create the numeric extended access-list whose serial No. is 110. deny icmp packet to pass, and permit udp packet with destination address 192. 168. 0. 1 and destination port 32 to pass.

Switch(Config)#access-list 110 deny icmp any-source any-destination

Switch(Config)#access-list 110 permit udp any-source host-destination 192.168.0.1 d-port 32

15.3.2.2 access-list(ip standard)

Command: access-list <*num*> {deny | permit} {{<*sIpAddr*> <*sMask* >} | any| {host <*sIpAddr*>}}

no access-list <*num*>

Functions: Create a numeric standard IP access-list. If this access-list exists, then add a rule list; the '**no access-list <*num*>**' operation of this command is to delete a numeric standard IP access-list.

Parameters: <*num*> is the No. of access-list, 100-199; **<*sIpAddr*>** is the source IP address, the format is dotted decimal notation; **<*sMask* >** is the reverse mask of source IP, the format is dotted decimal notation;

Command mode: Global Mode

Default: No access-lists configured.

Usage Guide: When the user assign specific **<*num*>** for the first time, ACL of the serial number is created, then the lists are added into this ACL.

Example: Create a numeric standard IP access-list whose serial No. is 20, and permit data packets with source address of 10.1.1.0/24 to pass, and deny other packets with source address of 10.1.1.0/16.

Switch(Config)#access-list 20 permit 10.1.1.0 0.0.0.255

Switch(Config)#access-list 20 deny 10.1.1.0 0.0.255.255

15.3.2.3 firewall

Command: firewall { enable | disable}
Functions: Enable or disable firewall
Parameters: enable means to enable of firewall; **disable** means to disable firewall.
Default: It is no use if default is firewall
Command mode: Global Mode
Usage Guide: Whether enabling or disabling firewall, access rules can be configured. But only when the firewall is enabled, the rules can be used in specific orientations of specific ports. When disabling the firewall, all ACL tied to ports will be deleted.
Example: Enable firewall
Switch(Config)#firewall enable

15.3.2.4 firewall default

Command: firewall default {permit | deny}
Functions: Configure default actions of firewall
Parameters: permit means to permit data packets to pass; **deny** means to deny data packets to pass
Command mode: Global Mode
Default: Default action is permit.
Usage Guide: This command only influences IP packets from the port entrance, and all packets can pass the switch in other situations.
Example: Configure firewall default action as permitting packets to pass.
Switch(Config)#firewall default permit

15.3.2.5 ip access extended

Command: ip access extended <*name*>
no ip access extended <*name*>
Function: Create and name a IP access list. If no is put in front of the command, the access list will be removed together with all the entries in the list.
Parameters: <*name*> is the name of the access list. The <name> should be a string of 1~16 characters, and should not be a numeric string
Command mode: Global Mode.
Default: No extended access list is defined by default.
Usage Guide: When this command is called for the first time, an empty access list will be created.
Example: Create an extended IP access list, and name it as tcpFlow.
Switch(Config)#ip access-list extended tcpFlow

15.3.2.6 ip access standard

Command: ip access standard <*name*>
no ip access standard <*name*>
Function: Create a name-based standard IP access list; the '**no ip access-list**

standard<*name*>'command deletes the name-based standard IPv6 access list (including all entries).

Parameters: <*name*> is the name for access list, the character string length is from 1 to 16, And the string should contain at least one non-numeric character..

Command mode: Global Mode

Default: No access list is configured by default

Usage Guide: When this command is called for the first time, an empty access list will be created.

Example: Create a standard IP access list, and name it as tcpFlow.

Switch(Config)#ip access-list standard ipFlow

15.3.2.7 {ip|mac|mac-ip} access-group

Command :{ip|mac|mac-ip} access-group <name> {in|out}[traffic-statistic]

no {ip|mac|mac-ip} access-group <name> {in|out}

Function: Apply an access-list on some direction of port, and determine if ACL rule is added statistic counter or not by options; the 'no {ip|mac|mac-ip} access-group command deletes access-list binding on the port.

Parameters: <*name*> is the name for access list, the character string length is from 1 to 16

Command mode: Physical Interface Mode.

Default: The exit and entry of port are not bound ACL.

Usage Guide: One interface can be bound with one outbound ACL and one inbound ACL. When an ACL is bound to an outbound interface, only deny rule can be configured. Currently ACL can only be bound to inbound interfaces, but can not be bound to outbound interfaces.

Standard ACLs, extended ACLs, and named ACLs can be bound to physical ports of the Layer 3 switches, and can not be bbound to Layer 3 ports or the trunk ports.

When binding ACLs to a port, it is limited that:

1. One MAC-IP ACL, or one IP-ACL, or MAC-ACL can be bound to each inbound port.
2. One MAC-IP ACL, or one IP-ACL, or MAC-ACL can be bound to each outbound port.
3. When inbound and outbound ACLs are both configured, and packets are matched by both of the ACLs, the priority of outbound ACL will be higher than the inbound one. In the same ACL, the earlier the entry is configued, the higher its priority will be.
4. Only the deny operation can be binded to the outbound ports.

When matching TCP or UDP port numbers, only one fixed port number can be used. Operators like not equal, bigger than, less than, or between are not allowed.

For packets uses software forwarding, and packets sent out by the switch itself, the outbound ACL does not effect.

Example: Configure a inbound access list named aaa to the port.

Switch(Config-Ethernet0/0/1)#ip access-group aaa in

15.3.2.8 permit|deny(ip extended)

Command: [no] {deny | permit} icmp {{<*slpAddr*> <*sMask*>} | any | {host <*slpAddr*>}} {{<*dlpAddr*> <*dMask*>} | any-destination | {host-destination <*dlpAddr*>}} [<*icmp-type*> [<*icmp-code*>]] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]
[no] {deny | permit} igmp {{<*slpAddr*> <*sMask*>} | any | {host <*slpAddr*>}} {{<*dlpAddr*> <*dMask*>} | any-destination | {host-destination <*dlpAddr*>}} [<*igmp-type*>] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]
[no] {deny | permit} tcp {{<*slpAddr*> <*sMask*>} | any | {host <*slpAddr*>}} [s-port <*sPort*>] {{<*dlpAddr*> <*dMask*>} | any-destination | {host-destination <*dlpAddr*>}} [d-port <*dPort*>] [ack+fin+psh+rst+urg+syn] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]
[no] {deny | permit} udp {{<*slpAddr*> <*sMask*>} | any | {host <*slpAddr*>}} [s-port <*sPort*>] {{<*dlpAddr*> <*dMask*>} | any-destination | {host-destination <*dlpAddr*>}} [d-port <*dPort*>] [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]
[no] {deny | permit} {eigrp | gre | igrp | ipinip | ip | <*int*>} {{<*slpAddr*> <*sMask*>} | any | {host <*slpAddr*>}} {{<*dlpAddr*> <*dMask*>} | any-destination | {host-destination <*dlpAddr*>}} [precedence <*prec*>] [tos <*tos*>][time-range<*time-range-name*>]

Functions: Create a name expansion IP access rule to match specific IP protocol or all IP protocol;

Parameters: <*slpAddr*> is the source IP address, the format is dotted decimal notation; **<*sMask* >** is the reverse mask of source IP, the format is dotted decimal notation; **<*dlpAddr*>** is the destination IP address, the format is dotted decimal notation; **<*dMask*>** is the reverse mask of destination IP, the format is dotted decimal notation, attentive position o, ignored position 1; **<*igmp-type*>**, the type of igmp, 0-15; **<*icmp-type*>**, the type of icmp, 0-255 ; **<icmp-code>,** protocol No. of icmp, 0-255; **<prec>**, IP priority, 0-7; **<*tos*>**, to value, 0-15; **<*sPort*>**, source port No., 0-65535; **<*dPort*>**, destination port No. 0-65535; **<*time-range-name*>**, time range name

Command mode: Name expansion IP access-list configuration mode

Default: No access-list configured

Usage Guide: None.

Example: Configure the switch to allow packets from the network of 10.1.1.0/24 to be forwarded, and deny any packets coming from the network of 10.1.1.0/16.

Switch(Config)# ip access-list standard ipFlow
Switch(Config-Std-Nacl-ipFlow)# permit 10.1.1.0 0.0.0.255
Switch(Config-Std-Nacl-ipFlow)# deny 10.1.1.0 0.0.255.255

15.3.2.9 access-list(mac standard)

Command: access-list <*num*> {deny|permit} {any-source-mac | {host-source-mac <*host_smac*> } | {<*smac*> <*smac-mask*>} }

no access-list <num>

Functions: Define a standard numeric MAC ACL rule, '**no access-list <num>**' command deletes a standard numeric MAC ACL access-list rule

Parameters: ***<num>*** is the access-list No. which is a decimal's No. from 700-799; ***deny*** if rules are matching, deny access; ***permit*** if rules are matching, permit access; ***<host_smac>, <sumac>*** source MAC address; ***<sumac-mask>*** mask (reverse mask) of source MAC address

Command mode: Global Mode

Default: No access-list configured

Usage Guide: When user assign specific ***<num>*** for the first time, ACL of the serial number is created, then the lists are added into this ACL.

Example: Configure the switch to allow packets from 00-00-xx-xx-00-01 to be forwarded, and deny any packets coming from 00-00-00-xx-00-ab.

Switch(Config)# access-list 700 permit 00-00-00-00-00-01 00-00-FF-FF-00-00

Switch(Config)# access-list 700 deny 00-00-00-00-00-ab 00-00-00-FF-00-00

15.3.2.10 access-list(mac extended)

Command: access-list<*access-list-number*>{deny|permit}{any-source-mac
|{ host-source-mac
<*host_smac*>}|{<*smac*><*smac-mask*>}}{any-destination-mac |
{host-destination-mac<*host_dmac*>}|{<*dmac*><*dmac-mask*>}}{unta
gged-eth2|tagged-eth2| untagged-802.3 |tagged-802.3}[<*offset1*>
***<length1>* <*value1*>** **[<*offset2*>** ***<length2>* <*value2*>** **[<*offset3*>**
***<length3>* <*value3*>** **[<*offset4*>** ***<length4>* <*value4*>**]]]]]
no access-list <access-list-number>

Functions: Define a standard numeric MAC ACL rule, '**no access-list <num>**' command deletes a standard numeric MAC ACL access-list rule

Parameters:

<num> is the access-list No. which is a decimal's No. from 1100-1199;

deny if rules arematching, deny access; ***permit*** if rules are matching, permit access; ***<any-source-mac>*** for any source address; ***<any-destination-mac>*** for any destination address; ***<host_smac>,<sumac>*** source MAC address; ***<sumac-mask>*** mask (reverse mask) of source MACaddress; ***<host_dmac> , <dmac>*** destination MAC address; ***<dmac-mask>*** mask(reverse mask) of destination MAC address; **untagged-eth2** format of untagged ethernetII packet; **tagged-eth2** format of tagged ethernet II packet; **untagged-802-3** format of untagged ethernet 802.3 packet; **tagged-802-3** format of tagged ethernet 802.3 packet;**Offset(x)** the offset from the packet head, the range is (12-79), the windows must start from the back of source MAC, and the windows cannot superpose each other, and that is to say: Offset(x＋1) must **be longer than** Offset(x)＋len（x）; ***Length(x)*** length is 1-4 ,and **Offset(x)**＋**Length(x) should not be longer than 80**（**currently should not be longer than 64**）**;** ***Value(x)*** **hex expression, Value range**: when **Length(x) =**1, it is 0-ff ,when **Length(x) =**2, it is 0-ffff , when **Length(x) =**3, it is0-ffffff, when **Length(x) =**4, it is0-ffffffff ;

For **Offset(x),** different types of data frames are with different value ranges:
for untagged-eth2 type frame: <12～51>
for untagged-802.2 type frame: <12～55>
for untagged-eth2 type frame: <12～59>
for untagged-eth2 type frame: <12～63>
Command mode: Global Mode
Default: No access-list configured
Usage Guide: When the user assign specific **<***num***>** for the first time, ACL of the serial number is created, then the lists are added into this ACL.
Example: Permit tagged-eth2 with any source MAC addresses and any destination MAC addresses, the fifth byte is 0x08,and the sixteenth bytes is 0x0 can pass.
Switch(Config)#access-list 1100 permit any-source-mac any-destination-mac tagged-eth2

15.3.2.11 mac access extended

Command: Mac-access-list extended <name>
no mac-access-list extended <name>
Functions: Define a name-manner MAC ACL or enter access-list configuration mode,no mac-access-list extended <*name*>' command deletes this ACL.
Parameters: <name> name of access-list excluding blank or quotation mark, and it must start with letter, and the length cannot exceed 16 (remark: sensitivity on capital or small letter.)
Command mode: Global Mode
Default: No access-lists configured
Usage Guide: After assigning this command for the first time, only an empty name access-list is created and no list item included.
Example: Create a extended mac based access list, and name it as MAC ACL.
Switch(Config)# mac-access-list extended mac_acl
Switch(Config-Mac-Ext-Nacl-mac_acl)#

15.3.2.12 permit | deny(mac extended)

Command:
[no]{deny|permit}
{any-source-mac|{host-source-mac<host_smac>}|{<smac><smac-mask>}}
{any-destination-mac|{host-destination-mac<host_dmac>}|{<dmac><dmac-mask>}}
[cos <cos-val> [<cos-bitmask>]] [vlanId <vid-value> [<vid-mask>]] [ethertype <protocol> [<protocol-mask>]]
[no]{deny|permit}
{any-source-mac|{host-source-mac<host_smac>}|{<smac><smac-mask>}}
{any-destination-mac|{host-destination-mac<host_dmac>}|{<dmac><dmac-mask>}}
[untagged-eth2 [ethertype <protocol> [protocol-mask]]]
[no]{deny|permit}
{any-source-mac|{host-source-mac<host_smac>}|{<smac><smac-mask>}}

{any-destination-mac|{host-destination-mac<host_dmac>}|{<dmac><dmac-mask>}}
[untagged-802-3]
[no]{deny|permit}
{any-source-mac|{host-source-mac<host_smac>}|{<smac><smac-mask>}}
{any-destination-mac|{host-destination-mac<host_dmac>}|{<dmac><dmac-mask>}}
[tagged-eth2 [cos <cos-val> [<cos-bitmask>]] [vlanId <vid-value> [<vid-mask>]]
[ethertype<protocol> [<protocol-mask>]]]
[no]{deny|permit}
{any-source-mac|{host-source-mac<host_smac>}|{<smac><smac-mask>}}
{any-destination-mac|{host-destination-mac<host_dmac>}|{<dmac><dmac-mask>}}
[tagged-802-3 [cos <cos-val> [<cos-bitmask>]] [vlanId <vid-value> [<vid-mask>]]]
Functions: Define an expansion name MAC ACL rule, and 'no' for this command deletes this expansion name IP access rule.
Parameters: any-source-mac: any source of MAC address; **any-destination-mac**: any destination of MAC address; **host_smac , smac**: source MAC address; **smac-mask**: mask (reverse mask) of source MAC address ; **host_dmac , dmas** destination MAC address; **dmac-mask** mask (reverse mask) of destination MAC address; **untagged-eth2** format of untagged ethernet II packet; **tagged-eth2** format of tagged ethernet II packet; **untagged-802-3** format of untagged ethernet 802.3 packet; **tagged-802-3** format of tagged ethernet 802.3 packet; ***cos-val*:** cos value, 0-7; ***cos-bitmask*:** cos mask, 0-7reverse mask and mask bit is consecutive; ***vid-value*:** vlan No, 1-4094; ***vid-bitmask* :**vlan mask, 0-4095, reverse mask and mask bit is consecutive; ***protocol*:** specific Ethernet protocol No., 1536-65535; ***protocol-bitmask*:** protocol mask, 0-65535, reverse mask and mask bit is consecutive.
Notice: mask bit is consecutive means the effective bit must be consecutively effective from the first bit on the left, no ineffective bit can be added through. For example: the reverse mask format of one byte is: 00001111b; mask format is 11110000; and this is not permitted: 00010011.
Command mode: Name expansion MAC access-list configuration mode
Default: No access-list configured
Usage Guide: None.
Example: Configure the switch to deny any packets destinated to 00-00-aa-bb-cc-xx with ethernet frame tag as ethernet II and ethernet protocol number as 2048.
Switch(Config-Mac-Ext-Nacl-me)#deny any-source-mac 00-00-aa-bb-cc-01 00-00-00-00-00-ff tagged-eth2 ethertype 2048

15.3.2.13 access-list(mac-ip extended)

Command:
[no]
{deny|permit}{any-source-mac|{host-source-mac<*host_smac*>}|{<*smac*><*smac-mask*>}}
{any-destination-mac|{host-destination-mac<*host_dmac*>}|{<*dmac*><*dmac-mask*>}}
icmp{{<*source*><*source-wildcard*>}|any|{host<*source-host-ip*>}}

{{<*destination*><*destination-wildcard*>}|any-destination|{host-destination <*destination-host-ip*>}} [<*icmp-type*> [<*icmp-code*>]] [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]
[no]{deny|permit} {any-source-mac|{host-source-mac<*host_smac*>}|{<*smac*><*smac-mask*>}} {any-destination-mac|{host-destination-mac<*host_dmac*>}|{<*dmac*><*dmac-mask*>}} igmp{{<*source*><*source-wildcard*>}|any| {host<*source-host-ip*>}} {{<*destination*><*destination-wildcard*>}|any-destination|{host-destination <*destination-host-ip*>}} [<*igmp-type*>] [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]
[no]{deny|permit}{any-source-mac|{host-source-mac<*host_smac*>}| {<*smac*><*smac-mask*>}}{any-destination-mac|{host-destination-mac<*host_dmac*>}| {<*dmac*><*dmac-mask*>}}tcp{{<*source*><*source-wildcard*>}|any| {host<*source-host-ip*>}}[s-port<*port1*>]{{<*destination*> <*destination-wildcard*>}|any-destination| {host-destination <*destination-host-ip*>}} [d-port <*port3*>] [ack＋fin＋psh＋rst＋urg＋syn] [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]
[no]{deny|permit}{any-source-mac|{host-source-mac<*host_smac*>}|{<*smac*> <*smac-mask*>}}{any-destination-mac|{host-destination-mac<*host_dmac*>}| {<*dmac*><*dmac-mask*>}}udp{{<*source*><*source-wildcard*>}|any| {host<*source-host-ip*>}}[s-port<*port1*>]{{<*destination*> <*destination-wildcard*>}|any-destination| {host-destination <*destination-host-ip*>}} [d-port <*port3*>] [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]
[no]{deny|permit}{any-source-mac|{host-source-mac<*host_smac*>}|{<*smac*> <*smac-mask*>}}{any-destination-mac|{host-destination-mac<*host_dmac*>}| {<*dmac*><*dmac-mask*>}}{eigrp|gre|igrp|ip|ipinip|ospf|{<*protocol-num*>}} {{<*source*><*source-wildcard*>}|any|{host<*source-host-ip*>}} {{<*destination*><*destination-wildcard*>}|any-destination|{host-destination <*destination-host-ip*>}} [precedence <*precedence*>] [tos <*tos*>][time-range<*time-range-name*>]

Functions: Define an expansion name MAC-IP ACL rule, ‘No’ form deletes one expansion numeric MAC-IP ACL access-list rule.

Parameters: num access-list serial No. this is a decimal’s No. from 3100-3199.; deny if rules are matching, deny to access; permit if rules are matching, permit to access; any-source-mac: any source MAC address; any-destination-mac: any destination MAC address; host_smac , smac: source MAC address; smac-mask: mask (reverse mask) of source MAC address ; host_dmac , dmas destination MAC address; dmac-mask mask (reverse mask) of destination MAC address; protocol No. of name or IP protocol. It can be a key word: eigrp, gre, icmp, igmp, igrp, ip, ipinip, ospf, tcp, or udp, or an integer from 0-255 of list No. of IP address. Use key word ‘ip’ to match all Internet protocols (including ICMP, TCP, and UDP) list; source-host-ip, source No. of source network or source host of packet delivery. Numbers of 32-bit binary system with dotted decimal notation expression; host-source: means the address is the IP address of source host, otherwise

the IP address of network; source-wildcard: reverse of source IP. Numbers of 32-bit binary system expressed by decimal's numbers with four-point separated, reverse mask; destination-host-ip, destination No. of destination network or host to which packets are delivered. Numbers of 32-bit binary system with dotted decimal notation expression; host-source: means the address is the destination host address, otherwise the network IP address; destination-wildcard: mask of destination. Numbers of 32-bit binary system expressed by decimal's numbers with four-point separated, reverse mask; s-port(optional): means the need to match TCP/UDP source port; port1(optional): value of TCP/UDP source interface No., Interface No. is an integer from 0-65535; d-port(optional): means need to match TCP/UDP destination interface; port3(optional): valueof TCP/UDP destination interface No., Interface No. is an integer from 0-65535; [ack] [fin] [psh] [rst] [urg] [syn], (optional) only for TCP protocol, multi-choices of tag positions are available, and when TCP data reports the configuration of corresponding position, then initialization of TCP data report is enabled to form a match when in connection; precedence (optional) packets can be filtered by priority which is a number from 0-7; tos (optional) packets can be filtered by service type which ia number from 0-15; icmp-type (optional) ICMP packets can be filtered by packet type which is a number from 0-255; icmp-code (optional) ICMP packets can be filtered by packet code which is a number from 0-255; igmp-type (optional) ICMP packets can be filtered by IGMP packet name or packet type which is a number from 0-255; <*time-range-name*>, name of time range

Command mode: Global Mode

Default: No access-list configured

Usage Guide: When the user assign specific <num> for the first time, ACL of the serial number is created, then the lists are added into this ACL.

Examples: Permit the passage of TCP packet with source MAC 00-12-34-45-XX-XX, any destination MAC address, source IP address 100.1.1.0 0.255.255.255, and source port 100 and destination interface 40000.

Switch(Config)# access-list 3199 permit 00-12-34-45-67-00 00-00-00-00-FF-FF any-destination-mac tcp 100.1.1.0 0.255.255.255 s-port 100 any-destination d-port 40000

15.3.2.14 mac-ip access extended

Command: Mac-ip-access-list extended <name>

no mac-ip-access-list extended <name>

Functions: Define a name-manner MAC-IP ACL or enter access-list configuration mode, **'**no mac-ip-access-list extended <*name*>' command deletes this ACL.

Parameters:<*name*> :name of access-list excluding blank or quotation mark, and it must start with letter, and the length cannot exceed 16 (remark: sensitivity on capital or small letter.)

Command mode: Global Mode

Default: No named MAC-IP access-list

Usage Guide: When this command is called, an empty access list will be created.

Example: Create a MAC-IP based ACL, and name it as MAC IP ACL

Switch(Config)# mac-ip-access-list extended macip_acl

Switch(Config-MacIp-Ext-Nacl-macip_acl)#

15.3.2.15 permit | deny(mac-ip extended)

Command:[no]
{deny|permit}{any-source-mac|{host-source-mac<*host_smac*>}|{<*smac*><*smac-mask*>}}
{any-destination-mac|{host-destination-mac<*host_dmac*>}|{<*dmac*><*dmac-mask*>}}
icmp{{<*source*><*source-wildcard*>}|any|{host<*source-host-ip*>}}
{{<*destination*><*destination-wildcard*>}|any-destination|{host-destination
<*destination-host-ip*>}} [<*icmp-type*> [<*icmp-code*>]] [precedence <*precedence*>]
[tos <*tos*>][time-range<*time-range-name*>]
[no]{deny|permit}
{any-source-mac|{host-source-mac<*host_smac*>}|{<*smac*><*smac-mask*>}}
{any-destination-mac|{host-destination-mac<*host_dmac*>}|{<*dmac*><*dmac-mask*>}}
igmp{{<*source*><*source-wildcard*>}|any| {host<*source-host-ip*>}}
{{<*destination*><*destination-wildcard*>}|any-destination|{host-destination
<*destination-host-ip*>}} [<*igmp-type*>] [precedence <*precedence*>] [tos
<*tos*>][time-range<*time-range-name*>]
[no]{deny|permit}{any-source-mac|{host-source-mac<*host_smac*>}|
{<*smac*><*smac-mask*>}}{any-destination-mac|{host-destination-mac<*host_dmac*>}|
{<*dmac*><*dmac-mask*>}}tcp{{<*source*><*source-wildcard*>}|any|
{host<*source-host-ip*>}}[s-port<*port1*>]{{<*destination*>
<*destination-wildcard*>}|any-destination| {host-destination <*destination-host-ip*>}}
[d-port <*port3*>] [ack＋fin＋psh＋rst＋urg＋syn] [precedence <*precedence*>] [tos
<*tos*>][time-range<*time-range-name*>]
[no]{deny|permit}{any-source-mac|{host-source-mac<*host_smac*>}|{<*smac*>
<*smac-mask*>}}{any-destination-mac|{host-destination-mac<*host_dmac*>}|
{<*dmac*><*dmac-mask*>}}udp{{<*source*><*source-wildcard*>}|any|
{host<*source-host-ip*>}}[s-port<*port1*>]{{<*destination*>
<*destination-wildcard*>}|any-destination| {host-destination <*destination-host-ip*>}}
[d-port <*port3*>] [precedence <*precedence*>] [tos
<*tos*>][time-range<*time-range-name*>]
[no]{deny|permit}{any-source-mac|{host-source-mac<*host_smac*>}|{<*smac*>
<*smac-mask*>}}{any-destination-mac|{host-destination-mac<*host_dmac*>}|
{<*dmac*><*dmac-mask*>}}{eigrp|gre|igrp|ip|ipinip|ospf|{<*protocol-num*>}}
{{<*source*><*source-wildcard*>}|any|{host<*source-host-ip*>}}
{{<*destination*><*destination-wildcard*>}|any-destination|{host-destination
<*destination-host-ip*>}} [precedence <*precedence*>] [tos
<*tos*>][time-range<*time-range-name*>]

Functions: Define an expansion name MAC-IP ACL rule, ‘No’ form deletes one expansion numeric MAC-IP ACL access-list rule.

Parameters: num access-list serial No. this is a decimal’s No. from 3100-3199.; deny: if rules are matching, deny to access; permit: if rules are matching, permit to access;

any-source-mac: any source MAC address; any-destination-mac: any destination MAC address; host_smac , smac: source MAC address; smac-mask: mask (reverse mask) of source MAC address ; host_dmac , dmas destination MAC address; dmac-mask mask (reverse mask) of destination MAC address; protocol No. of name or IP protocol. It can be a key word: eigrp, gre, icmp, igmp, igrp, ip, ipinip, ospf, tcp, or udp, or an integer from 0-255 of list No. of IP address. Use key word 'ip' to match all Internet protocols (including ICMP, TCP, AND UDP) list; source-host-ip, source No. of source network or source host of packet delivery. Numbers of 32-bit binary system with dotted decimal notation expression; host: means the address is the IP address of source host, otherwise the IP address of network; source-wildcard: reverse of source IP. Numbers of 32-bit binary system expressed by decimal's numbers with four-point separated, reverse mask; destination-host-ip, destination No. of destination network or host to which packets are delivered. Numbers of 32-bit binary system with dotted decimal notation expression; host-source: means the address is the destination host address, otherwise the network IP address; destination-wildcard: mask of destination. I Numbers of 32-bit binary system expressed by decimal's numbers with four-point separated, reverse mask; s-port(optional): means the need to match TCP/UDP source port; port1(optional): value of TCP/UDP source interface No., Interface No. is an integer from 0-65535; d-port(optional): means need to match TCP/UDP destination interface; port3(optional): value of TCP/UDP destination interface No., Interface No. is an integer from 0-65535; [ack] [fin] [psh] [rst] [urg] [syn], (optional) only for TCP protocol, multi-choices of tag positions are available, and when TCP data reports the configuration of corresponding position, then initialization of TCP data report is enabled to form a match when in connection; precedence (optional) packets can be filtered by priority which is a number from 0-7; tos (optional) packets can be filtered by service type which ia number from 0-15; icmp-type (optional) ICMP packets can be filtered by packet type which is a number from 0-255; icmp-code (optional) ICMP packets can be filtered by packet code which is a number from 0-255; igmp-type (optional) ICMP packets can be filtered by IGMP packet name or packet type which is a number from 0-255; <*time-range-name*>, name of time range

Command mode: Name expansion MAC-IP access-list configuration mode

Default: No access-list configured

Usage Guide: None.

Example: Deny the passage of UDP packets with any source MAC address and destination MAC address, any source IP address and destination IP address, and source port 100 and destination port 40000.

Switch(Config-Mac-Ext-Nacl-mie)#deny any-source-mac any-destination-mac udp any-source s-port 100 any-destination d-port 40000

15.3.2.16 time-range

Command: [no] time-range <time_range_name>

Functions: Create the name of time-range as time range name, enter the time-range mode at the same time.

Parameters:*time_range_name*,time range name must start with letter, and the length

cannot exceed 16-character long.
Command mode: Global Mode
Default: No time-range configuration
Usage Guide: None.
Example: Create a time-range named dc timer.
Switch(Config)#timer-range dc_timer

15.3.2.17 absolute-periodic/periodic

Command:
[no] absolute-periodic{Monday|Tuesday|Wednesday|Thursday|Friday|Saturday|Sunday}<start_time>to{Monday|Tuesday|Wednesday|Thursday|Friday|Saturday|Sunday} <end_time>
[no]periodic{{Monday+Tuesday+Wednesday+Thursday+Friday+Saturday+Sunday}|daily| weekdays | weekend} <start_time> to <end_time>
Functions: Define the time-range of different commands within one week, and every week to circulate subject to this time.
Parameters:
Friday （Friday)
Monday （Monday)
Saturday （Saturday)
Sunday （Sunday)
Thursday （Thursday）
Tuesday （Tuesday)
Wednesday （Wednesday)
daily （Every day of the week）
weekdays （Monday thru Friday）
weekend （Saturday thru Sunday）
start_time start time ,HH:MM:SS (hour: minute: second)
end_time end time,HH:MM:SS (hour: minute: second)
Remark: time-range polling is one minute per time, so the time error shall be <= one minute.
Command mode: Time-range Mode
Default: No time-range configuration
Usage Guide: Periodic time and date. The definition of period is specific time period of Monday to Saturday and Sunday every week.
day1 hh:mm:ss To day2 hh:mm:ss or
{[day1+day2+day3+day4+day5+day6+day7]|weekend|weekdays|daily} hh:mm:ss To hh:mm:ss
Example: Make configurations effective within the period from9:15:30 to 12:30:00 during Tuesday to Saturday.
Switch(Config)#time-range dc_timer
Switch(Config-Time-Range)#absolute-periodic tuesday 9:15:30 to saturday 12:30:00
Make configurations effective within the period from 14:30:00 to 16:45:00 on Monday,

Wednesday, Friday and Sunday.
Switch(Config-Time-Range)#periodic monday wednesday friday sunday 14:30:00 to 16:45:00

15.3.2.18 absolute start

Command: [no]absolute start <*start_time*> <*start_data*> [end <*end_time*> <*end_data*>]
Functions: Define an absolute time-range, this time-range operates subject to the clock of this equipment.
Parameters:
start_time : start time, HH:MM:SS (hour: minute: second)
end_time : end time, HH:MM:SS (hour: minute: second)
start_data **:** start data, the format is, YYYY.MM.DD（year.month.day）
end_data **:** end data, the format is, YYYY.MM.DD（year.month.day）
Remark: time-range is one minute per time, so the time error shall be <= one minute.
Command mode: Time-range Mode
Default: No time-range configuration
Usage Guide: Absolute time and date, assign specific year, month, day, hour, minute of the start, shall not configure multiple absolute time and date, when in repeated configuration, the latter configuration covers the absolute time and date of the former configuration.
Example: Make configurations effective from 6:00:00 to 13:30:00 from Oct. 1, 2004 to Jan. 26, 2005.
Switch(Config)#Time-range dcn_timer
Switch(Config-Time-Range)#absolute start 6:00:00 2004.10.1 end 13:30:00 2005.1.26

15.4 ACL Example

Scenario 1:
The user has the following configuration requirement: port 1/10 of the switch connects to 10.0.0.0/24 segment, ftp is not desired for the user.
Configuration description:
Create a proper ACL
Configuring packet filtering function
Bind the ACL to the port
The configuration steps are listed below:
Switch(Config)#access-list 110 deny tcp 10.0.0.0 0.0.0.255 any-destination d-port 21
Switch(Config)#firewall enable
Switch(Config)#firewall default permit

Switch(Config)#interface ethernet 0/0/10
Switch(Config-Ethernet0/0/10)#ip access-group 110 in

Switch(Config-Ethernet0/0/10)#exit
Switch(Config)#exit
Configuration result:
Switch#show firewall
Firewall is enabled.
Firewall default rule is to permit any packet.
Switch#show access-lists
access-list 110(used 1 time(s))
    access-list 110 deny tcp 10.0.0.0 0.0.0.255 any-destination d-port 21

Switch#show access-group interface ethernet 0/0/10
interface name:Ethernet0/0/10
     the ingress acl use in firewall is 110.

Scenario 2:
The user has the following configuration requirement: port 1/10 of the switch connects to 00-12-11-23-XX-XX segment, 802.3 is not desired for the user.
Configuration description:
a)Create a proper ACL
b)Configuring packet filtering function
c)Bind the ACL to the port
The configuration steps are listed below:
Switch(Config)#access-list 1100 deny 00-12-11-23-00-00 00-00-00-00-ff-ff any-destination-mac untagged-802.3
Switch(Config)#access-list 1100 deny 00-12-11-23-00-00 00-00-00-00-ff-ff any-destination-mac tagged-802.3
Switch(Config)#firewall enable
Switch(Config)#firewall default permit

Switch(Config)#interface ethernet 0/0/10
Switch(Config-Ethernet0/0/10)#ip access-group 1100 in
Switch(Config-Ethernet0/0/10)#exit
Switch(Config)#exit
Configuration result:
Switch#show firewall
Firewall is enabled.
Firewall default rule is to permit any packet.
Switch #show access-lists
access-list 1100(used 1 time(s))
    access-list 1100 deny 00-12-11-23-00-00 00-00-00-00-FF-FF any-destination-mac untagged-802.3
    access-list 1100 deny 00-12-11-23-00-00 00-00-00-00-FF-FF any-destination-mac tagged-802.3

Switch #show access-group
interface name:Ethernet0/0/10
MAC Ingress access-list used is 1100.

Scenario 3:
The user has the following configuration requirement: port 1/10 of the switch connects to 00-12-11-23-XX-XX segment, IP is 10.0.0.0/24 segment , ftp is not desired for the user.

Configuration description:
a)Create a proper ACL
b)Configuring packet filtering function
c)Bind the ACL to the port
The configuration steps are listed below:
Switch(Config)#access-list 3110 deny 00-12-11-23-00-00 00-00-00-00-FF-FF any-destination-mac tcp 10.0.0.0 0.0.0.255 any-destination d-port 21

Switch(Config)#firewall enable
Switch(Config)#firewall default permit

Switch(Config)#interface ethernet 0/0/10
Switch(Config-Ethernet0/0/10)#mac-ip access-group 3110 in
Switch(Config-Ethernet0/0/10)#exit
Switch(Config)#exit
Configuration result:
Switch#show firewall
Firewall is enabled.
Firewall default rule is to permit any packet.
Switch#show access-lists
access-list 3110(used 1 time(s))
access-list 3110 deny 00-12-11-23-00-00 00-00-00-00-FF-FF any-destination-mac tcp 10.0.0.0 0.0.0.255 any-destination d-port 21

Switch #show access-group
interface name:Ethernet0/0/10
MAC-IP Ingress access-list used is 3110.

15.5 ACL Troubleshooting

15.5.1 Monitor and Debug Command List

15.5.1.1 show access-lists

Command: show access-lists [<num>|<acl-name>]
Functions: Reveal ACL of configuration
Parameters: *<acl-name>*, specific ACL name character string; ***<num>,*** specific ACL No.
Default: None
Command mode: Admin Mode
Usage Guide: When not assigning names of ACL, all ACL will be revealed, used x time （s）indicates the times of ACL to be used.
Example:

```
Switch#show access-lists
access-list 10(used 0 time(s))
    access-list 10 deny any-source

access-list 100(used 1 time(s))
    access-list 100 deny ip any-source any-destination
    access-list 100 deny tcp any-source any-destination

access-list 1100(used 0 time(s))
    access-list 1100 permit any-source-mac any-destination-mac tagged-eth2 14 2 0800

access-list 3100(used 0 time(s))
    access-list 3100 deny any-source-mac any-destination-mac udp any-source s-port 100
any-destination d-port 40000
```

Displayed information	Explanation
access-list 10(used 0 time(s))	Number ACL10, 0 time to be used
access-list 10 deny any-source	Deny any IP packets to pass
access-list 100(used 1 time(s))	Nnumber ACL10, 1 time to be used
access-list 100 deny ip any-source any-destination	Deny IP packet of any source IP address and destination address to pass
access-list 100 deny tcp any-source any-destination	Deny TCP packet of any source IP address and destination address to pass
access-list 1100 permit any-source-mac any-destination-mac tagged-eth2 14 2 0800	Permit tagged-eth2 with any source MAC addresses and any destination MAC addresses and the packets whose 15^{th} and 16^{th} byte is respectively 0x08 , 0x0 to pass
access-list 3100 permit any-source-mac any-destination-mac udp any-source s-port 100 any-destination d-port 40000	Deny the passage of UDP packets with any source MAC address and destination MAC address, any source IP address and destination IP address, and source port 100 and destination interface 40000

15.5.1.2 show access-group

Command: show access-group [interface [Ethernet] <name>]

Functions: Reveal tying situation of ACL on port
Parameters: <*name*>,Interface name
Default: None
Command Mode: Admin mode
Usage Guide: When not assigning interface names, all ACL tied to port will be revealed
Example:

```
Switch#show access-group
interface name:Ethernet0/0/2
    IP Ingress access-list used is 111.
interface name:Ethernet0/0/1
IP Ingress access-list used is 10.
```

Displayed information	Explanation
interface name:Ethernet0/0/2	Tying situation on port Ethernet0/0/2
IP Ingress access-list used is 111	No. 111 numeric expansion ACL tied to entrance of port Ethernet0/0/2
interface name:Ethernet0/0/1	Tying situation on port Ethernet0/0/1
IP Ingress access-list used is 10	No. 10 standard expansion ACL tied to entrance of port Ethernet0/0/1

15.5.1.3 show firewall

Command: show firewall
Functions: Reveal configuration information of packet filtering functions
Parameters: None
Default: None
Command mode: Admin Mode
Usage Guide:
Examples:

```
Switch#show firewall
Firewall is enabled.
Firewall default rule is to permit any packet.
```

Displayed information	Explanation
fire wall is enable	Packet filtering function enabled
the default action of firewall is permit	Default packet filtering function is permit

15.5.1.4 show time-range

Command: show time-range<word>
Functions: Reveal configuration information of time range functions
Parameters: ***word*** assign name of time-range needed to be revealed
Default: None
Usage Guide: When not assigning time-range names, all time-range will be revealed.
Example:

```
Switch#show time-range
time-range timer1 (inactive)
        absolute-periodic Saturday 0:0:0 to Sunday 23:59:59
time-range timer2 (active)
absolute-periodic Monday 0:0:0 to Friday 23:59:59
```

15.5.2 ACL Troubleshooting

- The check of list entris in ACL is a top-down behavior, once one entry is mached, the check will be finished immediately;
- Only when there is no ACL binded or no ACL entry mached on the special direction of the port, the default rules will be used;
- Each port ingress can bind one MAC-IP ACL or one IP ACL or one MAC ACL；
- Each port egress can bind one MAC-IP ACL or one IP ACL or one MAC ACL
- When two sets of ACL are binded to the ingress and egress simultaneously, the priority of the egress rules is higher than that of ingress rules; in the same set of ACL, the earlier the rule is configurated, the higher its priority is;
- When one ACL is binded to egress direction of the port, it can only include deny list entries;
- Only the interfaces on the MASTER switch can support the binding of ACL;
- The number of ACL that can be binded successfully is dependent on the content of binded ACL and the limitation of hardware resource;
- If there are some rules including the same filtering information but conflicting behavior in the access-list, it can not be binded to the port, and will cause an error prompt. For example: configure permit tcp any-source any-destination and deny tcp any-source any-destination at the same time.
- Viruses such as ‘worm.blaster’ can be blocked by configuring ACL to block specific ICMP packets or specific TCP or UDP port packet.
- ACL can only be bound to inbound interfaces, and can not be bound to outbound interfaces currently.

Chapter 16 AM Configuration

16.1 AM Introduction

AM（access management） compares the information of the received data message (source IP address or source IP + source MAC) with the configured hardware address pool, if founds a match, forwards the message, if not, dumps it.

16.2 AM pool

AM pool is an address list, each entry of this address list corresponds with a user. Each entry contains address information and its corresponding port. There two kinds of address information：

IP address(ip-pool), specifies the user's source IP address information of the port.

MAC-IP address (mac-ip pool)，specifies the user's source MAC address and source IP address information of the port.

The default AM action is to deny. When the AM is enabled, the AM module will deny all the IP messages(only allows the source addresses of the members of the IP pool), when AM is disabled, it will delete all the address pools.

16.3 AM Configuration

16.3.1 AM Configuration Task List

1. Enable AM
2. Configure IP address on an interface
3. Configure MAC-IP address on an interface
4. Delete all the address pools

1. Enable AM

Command	Explanation
Global configuration mode	
am enable **no am enable**	Enable the AM access management function to configure address pools. The 'no am enable' command will disable AM and delete all the address pools.

2. Configure IP address on an interface

Command	Explanation
Physical interface configuration mode	
am port **no am port**	Enable or disable the AM function of a physical interface.
am ip-pool <*start_ip_address*> [<*num*>] **no am ip-pool <*start_ip_address*> [<*num*>]**	Configure IP address on a physical interface. The 'no am ip-pool <start_ip_address> [<num>] ' command will delete all the configured IP addresses on the interface.

3. Configure MAC-IP address on an interface

Command	Explanation
Physical interface configuration mode	
am mac-ip-pool<mac_*address*> <*ip_address*> **no am mac-ip-pool <mac_*address*>< *ip_address*>**	Configure MAC-IP address on a physical interface. The 'no am mac-ip-pool <mac_address>< ip_address>' command will delete all the configured MAC-IP addresses on the interface.

4. Delete all the address pools

Command	Explanation
Global configuration mode	
no am all {ip-pool|mac-ip-pool}	Delete all the MAC-IP pools or IP pools configured by the users.

16.3.2 AM Command List

16.3.2.1 am enable

Command: am enable
no am enable
Function: Enable the access management. If am enable is configured, the AM module will deny any packets to be delivered. If no is put in front of this command, this command will be disabled, and IP address pool and MAC address pool will be removed.
Parameters: None.
Command mode: Global Mode.
Default: AM configuration is disabled by default.
Usage Guide: If AM is enabled, the switch will deny any packets to be delivered. IP addresses or MAC-IP address mappings should be configured before any packets can be delivered. When the AM configuration is removed, all the IP addresses and MAC-IP address mappings configured by the users will be removed either.
Example: Enable AM configuration.
Switch(Config)#am enable

16.3.2.2 am port

Command: am port
no am port
Function: Enable the AM function for the physical ports**.**
Parameters: None.
Command mode: Port Mode.
Default: The AM function is enabled by default.
Usage Guide: Users can disable the AM function for physical ports. This command is usually used on uplink ports.
Example: Disable the AM function for ethernet 0/0/1.
Switch(Config)#am enable
Switch(Config)#interface Ethernet 0/0/1
Switch(Config-Ethernet0/0/1)#am port

16.3.2.3 am ip-pool

Command: am ip-pool <*start_ip_address*> [<*num*>]
no am ip-pool <*start_ip_address*> [<*num*>]
Function: Create a pool of IP addresses. If no is put in front of this command,the address pool will be removed.
Parameters: <*start_ip_address*> is the start address of the address pool. **<*num*>** is the number of address to be created in the pool with <start_ip_address> as the beginning，the default is 1.
Command mode: Port Mode.
Default: The IP pool is empty by default.
Usage Guide: Users can allow packets with source addresses defined in the adderss pool to be delivered by configuring this command.
Example: Configure AM on ethernet interface 0/0/4 to all packets with source addresses between 192.1.1.2 and 192.1.1.10 to be delivered.
Switch(Config)#am enable
Switch(Config)#interface Ethernet 0/0/4
Switch(Config-Ethernet0/0/4)#am port
Switch(Config-Ethernet0/0/4)#ip pool 192.1.1.2 9

16.3.2.4 am mac-ip-pool

Command: am mac-ip-pool <*mac_address*> <*ip_address*>
no am mac-ip-pool <*mac_address*> <*ip_address*>
Function: Create or remove a MAC-IP address mapping pool.
Parameters: <*mac_address*> is the source MAC address in the format of HH-HH-HH-HH-HH-HH.**<*ip_address*>** is the source IP address, which is represented in dotted decimals.
Command mode: Port Mode.

Default: The MAC-IP pool is empty by default.
Usage Guide: This command is used to configure MAC-IP address mapping pool. Only if the packets with source address that comply with the rule can be forwarded.
Example: Enable AM on ethernet interface 0/0/4 to allow packets from 192.1.1.2 with mac address as 00-01-10-22-33-10 to be delivered..
Switch(Config)#am enable
Switch(Config)#interface Ethernet 0/0/4
Switch(Config-Ethernet0/0/4)#am port
Switch(Config-Ethernet0/0/4)#mac-ip pool 00-01-10-22-33-10 192.1.1.2

16.3.2.5 no am all

Command: no am all {ip-pool|mac-ip-pool}
Function: Remove all user configured in the MAC-IP mapping pool or the IP pool.
Parameters: ***ip-pool*** is the IP address pool. ***mac-ip-pool*** is the mac-ip mapping address pool. ***all*** is the IP and MAC address pool.
Command mode: Global Mode.
Default: None. None is configued by default.
Usage Guide: This command can be used to clear the IP addresses or the IP-MAC mappings in the address pool,
Example:
Switch(Config)#no am all mac-ip-pool

16.4 AM Example

Scenario 1

The configuration demand of the user is that the port 10 of the switch connects to the 10.1.1.0/8 segment, the administrator hopes that 8 IP addresses from 10.1.1.1 to 10.1.1.8 8 can be allowed to access Internet.

Change Configuration：
Enable AM function；
Configure IP pool；

The following is the configuration procedure:

Switch(Config)#am enable
Switch(Config)#interface ethernet 0/0/1
Switch(Config-Ethernet0/0/1)#am port
Switch(Config-Ethernet0/0/1)#am ip-pool 10.1.1.1 8
Switch(Config-Ethernet0/0/1)#exit
Switch(Config)#exit
Configuration result:
Switch#show am

Global AM is enabled
Interface Ethernet0/0/1 am is enable
Interface Ethernet0/0/1
am ip-pool 10.1.1.1 8 USER_CONFIG

Scenario 2

The configuration demand of the user is that the port 10 of the switch connects to the 10.1.1.0/8 segment, the administrator hopes the binding relationships between users and MAC+IP are user1(100.1.1.1，00-00-00-00-01-12),user2(100.1.1.2，00-00-00-00-00-13).

Change Configuration：

Enable AM function；
Configure MAC-IP pool；

The following is the configuration procedure:

Switch(Config)#am enable
Switch(Config)#interface ethernet 0/0/10
Switch(Config-Ethernet0/0/10)#am port
Switch(Config-Ethernet0/0/10)#am mac-ip-pool 00-00-00-00-01-12 100.1.1.1
Switch(Config-Ethernet0/0/10)#am mac-ip-pool 00-00-00-00-00-13 100.1.1.2
Switch(Config-Ethernet0/0/10)#exit
Switch(Config)#exit

Configuration result:

Switch#show am
Global AM is enabled
Interface Ethernet0/0/10 am is enable
Interface Ethernet0/0/10
am mac-ip-pool 00-00-00-00-00-13 100.1.1.2 USER_CONFIG
am mac-ip-pool 00-00-00-00-01-12 100.1.1.1 USER_CONFIG

16.5 AM Troubleshooting

16.5.1 AM Debug and Monitor Command List

16.5.1.1 show am

Command：show am [interface <interfaceName>]
Function：Display the address entries configured on the current switch.
Parameters：***interfaceName :*** name of the physical interface
Command mode：Global Mode
Default：None
Usage Guide: If the interface is not specified, all access list will be displayed.
Example:

```
Switch#show am
Global AM is enabled
Interface Ethernet0/0/10
        am mac-ip-pool   00-00-00-00-00-13 100.1.1.2 USER_CONFIG
        am mac-ip-pool   00-00-00-00-01-12 100.1.1.1 USER_CONFIG
Interface Ethernet0/0/1
        am ip-pool 10.1.1.1   8          USER_CONFIG
```

Displayed information	Explanation
Global AM is enabled	AM is enabled
am mac-ip-pool 00-00-00-00-00-13 100.1.1.2 USER_CONFIG	Only the users whose source MAC＝ 00-00-00-00-00-13 and source IP=100.1.1.2 can pass, this is configured by users.
am mac-ip-pool 00-00-00-00-01-12 100.1.1.1 USER_CONFIG	Only the users whose source MAC＝ 00-00-00-00-01-12 and source IP=100.1.1.1can pass, this is configured by users.
am ip-pool 10.1.1.1 8 USER_CONFIG	Only the users whose source IP=10.1.1.1～ 10.1.1.8 can pass, this is configured by users.

16.5.2 AM Troubleshooting

- ☞ Since there is only limited hardware resources for AM, each port can configure 507 entries at most.
- ☞ The AM resource requires that the IP addresses and MAC addresses configured by users cannot conflict, that is the different users on the same switch cannot have the same IP or MAC configuration.

Chapter 17 Port Channel Configuration

17.1 Introduction to Port Channel

To understand Port Channel, Port Group should be introduced first. Port Group is a group of physical ports in the configuration level; only physical ports in the Port Group can take part in link aggregation and become a member port of a Port Channel. Logically, Port Group is not a port but a port sequence. Under certain conditions, physical ports in a Port Group perform port aggregation to form a Port Channel that has all the properties of a logical port, therefore it becomes an independent logical port. Port aggregation is a process of logical abstraction to abstract a set of ports (port sequence) with the same properties to a logical port. Port Channel is a collection of physical ports and used logically as one physical port. Port Channel can be used as a normal port by the user, and can not only add network's bandwidth, but also provide link backup. Port aggregation is usually used when the switch is connected to routers, PCs or other switches.

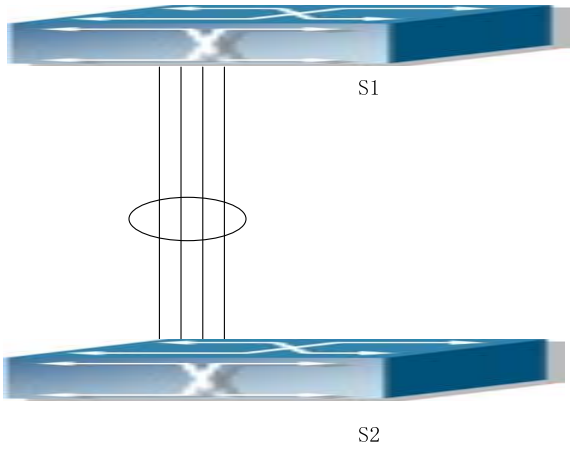


Fig 17-1 Port aggregation

As shown in the above figure, Switch1 is aggregated to a Port Channel, the bandwidth of this Port Channel is the total of all the four ports. If traffic from SwitchA needs to be transferred to SwitchB through the Port Channel, traffic allocation calculation will be performed based on the source MAC address and the lowest bit of target MAC address. The calculation result will decide which port to convey the traffic. If a port in Port Channel fails, the other ports will undertake traffic of that port through a traffic allocation algorithm. This algorithm is carried out by the hardware.

DCS-3950 series switch offers 2 methods for configuring port aggregation: manual Port Channel creation and LACP (Link Aggregation Control Protocol) dynamic Port Channel creation. Port aggregation can only be performed on ports in full-duplex mode. For Port Chansnel to work properly, member ports of the Port Channel must have the

same properties as follows:

- All ports are in full-duplex mode.
- All Ports are of the same speed.
- All Ports are of the same type
- All ports are Access ports and belong to the same VLAN or are all Trunk ports.
- If the ports are Trunk ports, then their 'Allowed VLAN' and 'Native VLAN' property should also be the same.

If Port Channel is configured manually or dynamically on DCS-3950 series switch, the system will automatically set the port with the smallest number to be Master Port of the Port Channel. If the spanning tree function is enabled in the switch, the spanning tree protocol will regard Port Channel as a logical port and send BPDU frames via the master port.

Port aggregation is closely related with switch hardware. DCS-3950 series switch allow physical port aggregation of any two switches, maximum 8 port groups and 8 ports in each port group are supported.

Once ports are aggregated, they can be used as a normal port. DCS-3950 series switch have a built-in aggregation interface configuration mode, the user can perform related configuration in this mode just like in the VLAN and physical port configuration mode.

17.2 Port Channel Configuration

17.2.1 Port Channel Configuration Task List

1. Create a port group in Global Mode.
2. Add ports to the specified group from the Port Mode of respective ports.
3. Enter port-channel configuration mode.

1. Creating a port group

Command	Explanation
Global Mode	
port-group <*port-group-number*> **[load-balance { dst-src-mac }]** **no port-group <port-group-number>** **[load-balance]**	Creates or deletes a port group and sets the load balance method for that group.

2. Add physical ports to the port group

Command	Explanation

Interface Mode	
port-group <*port-group-number*> mode {active|passive|on} **no port-group <*port-group-number*>**	Adds ports to the port group and sets their mode.

3. Enter port-channel configuration mode.

Command	Explanation
Global Mode	
interface port-channel <*port-channel-number*>	Enters port-channel configuration mode.

17.2.2 Port ChannelConfiguration Command List

17.2.2.1 port-group

Command: port-group <*port-group-number*> [load-balance {dst-src-mac}]
no port-group <*port-group-number*> [load-balance]

Function: Create a port group and sets the load balance method for that group. If no method is specified, the default load balance method is used. The '**no port-group <*port-group-number*> [load-balance]**' command deletes that group or restores the default load balance setting. Enter 'load-balance' for restoring default load balance, otherwise, the group will be deleted.

Parameters: <*port-group-number*> is the group number of a port channel from 1 to 8, if the group number is already exist, an error message will be given. **dst-src-mac** performs load balancing according to source and destination MAC;

If a port group has formed a port-channel, the load balance setting cannot be modified, please set the load balance mode before port-channel.

Default: Switch ports do not belong to a port channel by default; LACP not enabled by default.

Command mode: Global Mode

Example: Create a new port group with the default load balancing method.

Switch(Config)#port-group 1

To remove a port group.

Switch(Config)#no port-group 1

17.2.2.2 port-group mode

Command: port-group <port-group-number> mode {active|passive|on}
no port-group <port-group-number>

Function: Add a physical port to port channel, the '**no port-group <*port-group-number*>**' removes specified port from the port channel.

Parameters: <*port-group-number*> is the group number of port channel, from 1 to 8; **active** enables LACP on the port and sets it in Active mode; **passive** enables LACP on the port and sets it in Passive mode; **on** forces the port to join a port channel without enabling LACP.
Command mode: Interface Mode
Default: Switch ports do not belong to a port channel by default; LACP not enabled by default.
Usage Guide: If the specified port group does not exist, a group will be created first to add the ports. All ports in a port group must be added in the same mode, i.e., all ports use the mode used by the first port added. Adding a port in 'on' mode is a 'forced' action, which means the local end switch port aggregation does not rely on the information of the other end, port aggregation will succeed as long as there are 2 or more ports in the group and all ports have consistent VLAN information. Adding a port in 'active' or 'passive' mode enables LACP. Ports of at least one end must be added in 'active' mode, if all the ports are in passive mode, they can not form a group.
Example: In the port mode for ethernet 0/0/1, configure the port to be added to port group 1 in active mode.
Switch(Config-Ethernet0/0/1)#port-group 1 mode active

17.2.2.3 interface port-channel

Command: interface port-channel <port-channel-number>
Function: Enter the port channel configuration mode
Command mode: Global Mode
Default： None
Usage Guide: On entering aggregated port mode, configuration to GVRP or spanning tree modules will apply to aggregated ports; if the aggregated port does not exist (i.e., ports have not been aggregated), an error message will be displayed and configuration will be saved and will be restored until the ports are aggregated. Note such restoration will be performed only once, if an aggregated group is ungrouped and aggregated again, the initial user configuration will not be restored. If it is configuration for modules, such as shutdown or speed configuration, then the configuration to current port will apply to all member ports in the corresponding port group.
Example: Enter configuration mode for port-channel 1.
Switch(Config)#interface port-channel 1
Switch(Config-If-Port-Channel1)#

17.3 Port Channel Example

Scenario 1: Configuring Port Channel in LACP.

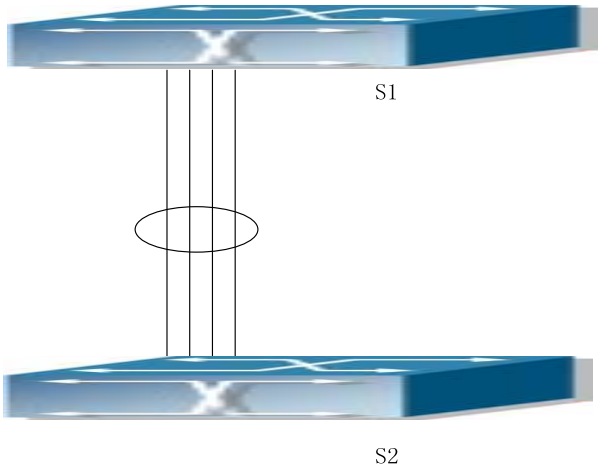


Fig 17-2 Configuring Port Channel in LACP

Example: The switches in the description below are all DCS-3950 series switch and as shown in the figure, ports 1, 2, 3 of Switch1 are access ports that belong to vlan1. Add those three ports to group1 in active mode. Ports 6, 7, 8 of Switch2 are trunk ports that also belong to vlan1,and allow all. Add these three ports to group2 in passive mode. All the ports should be connected with cables

The configuration steps are listed below:

Switch1#config
Switch1 (Config)#interface eth 0/0/1-3
Switch1 (Config-Port-Range)#port-group 1 mode active
Switch1 (Config-Port-Range)#exit
Switch1 (Config)#interface port-channel 1
Switch1 (Config-If-Port-Channel1)#

Switch2#config
Switch2 (Config)#port-group 2
Switch2 (Config)#interface eth 0/0/6
Switch2 (Config-Ethernet0/0/6)#port-group 2 mode passive
Switch2 (Config-Ethernet0/0/6)#exit
Switch2 (Config)# interface eth 0/0/8-9
Switch2 (Config-Port-Range)#port-group 2 mode passive
Switch2 (Config-Port-Range)#exit
Switch2 (Config)#interface port-channel 2
Switch2 (Config-If-Port-Channel2)#

Configuration result:

Shell prompts ports aggregated successfully after a while, now ports 1, 2, 3of Switch 1 form an aggregated port named ‘Port-Channel1’, ports 6, 7, 8 of Switch 2 forms an aggregated port named ‘Port-Channel2’; configurations can be made in their respective aggregated port configuration mode.

Scenario 2: Configuring Port Channel in ON mode.

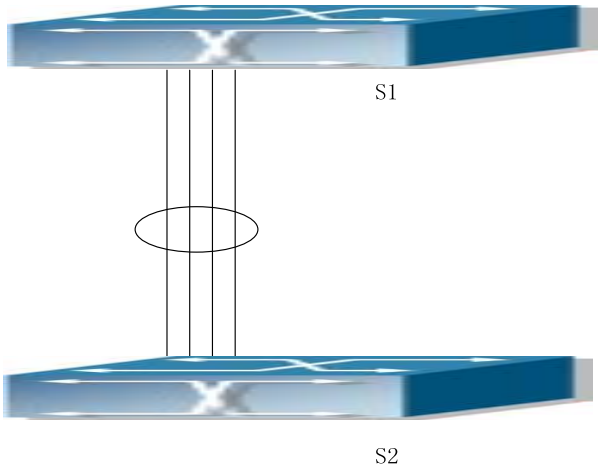


Fig 17-3 Configuring Port Channel in ON mode

Example: As shown in the figure, ports 1, 2, 3 of Switch1 are access ports that belong to vlan1. Add those three port to group1 in ‘on’ mode. Ports 6, 7, 8 of Switch2 are trunk ports that also belong to vlan1, and allow all,and add the these four ports to group2 in ‘on’ mode

The configuration steps are listed below:

Switch1#config
Switch1 (Config)#interface eth 0/0/1
Switch1 (Config-Ethernet0/0/1)# port-group 1 mode on
Switch1 (Config-Ethernet0/0/1)#exit
Switch1 (Config)#interface eth 0/0/2
Switch1 (Config-Ethernet0/0/2)# port-group 1 mode on
Switch1 (Config-Ethernet0/0/2)#exit
Switch1 (Config)#interface eth 0/0/3
Switch1 (Config-Ethernet0/0/3)# port-group 1 mode on
Switch1 (Config-Ethernet0/0/3)#exit

Switch2#config
Switch2 (Config)#port-group 2
Switch2 (Config)#interface eth 0/0/6
Switch2 (Config-Ethernet0/0/6)#port-group 2 mode on
Switch2 (Config-Ethernet0/0/6)#exit
Switch2 (Config)# interface eth 0/0/8-9
Switch2 (Config-Port-Range)#port-group 2 mode on
Switch2 (Config-Port-Range)#exit

Configuration result:

Add ports 1, 2, 3 of Switch 1 to port-group 1 in order, and we can see a group in ‘on’ mode is completely joined forcedly, switch in other ends won’t exchange LACP BPDU to complete aggregation. Aggregation finishes immediately when the command to add port 2

to port-group 1 is entered, port 1 and port 2 aggregate to be port-channel 1, when port 3 joins port-group 1, port-channel 1 of port 1 and 2 are ungrouped and re-aggregate with port 3 to form port-channel 1. (It should be noted that whenever a new port joins in an aggregated port group, the group will be ungrouped first and re-aggregated to form a new group.) Now all four ports in both SwitchA and SwitchB are aggregated in 'on' mode and become an aggregated port respectively.

17.4 Port Channel Troubleshooting

17.4.1 Debug and Monitor Command List

17.4.1.1 show port-group

Command: show port-group [<*port-group-number*>] {brief | detail | load-balance | port | port-channel}

Parameters: <*port-group-number*> is the group number of port channel to be displayed, from 1 to 16; **'brief'** displays summary information; **'detail'** displays detailed information; **'load-balance'** displays load balance information; **'port'** displays member port information; **'port-channel'** displays port aggregation information.

Command mode: Admin Mode

Usage Guide: If 'port-group-number' is not specified, then information for all port groups will be displayed.

Example: Add port 0/0/1 and 0/0//2 to port-group 1.

1. Display summary information for port-group 1.

Switch#show port-group 1 brief

Port-group number : 1

Number of ports in group : 2 Maxports = 8

Number of port-channels : 0 Max port-channels : 1

Displayed information	Explanation
Number of ports in group	Port number in the port group
Maxports	Maximum number of ports allowed in a group
Number of port-channels	Whether aggregated to port channel or not
Max port-channels	Maximum port channel number can be formed by port group.

2. Display detailed information for port-group 1

Switch# show port-group 1 detail

Sorted by the ports in the group 1:

---

port Ethernet0/0/1 :

both of the port and the agg attributes are not equal

the general information of the port are as follows:
portnumber: 1 actor_port_agg_id:0 partner_oper_sys:0x000000000000
partner_oper_key: 0x0001 actor_oper_port_key: 0x0101
mode of the port: ACTIVE lacp_aware: enable
begin: FALSE port_enabled: FALSE lacp_ena: FALSE ready_n: TRUE

the attributes of the port are as follows:
mac_type: ETH_TYPE speed_type: ETH_SPEED_10M
duplex_type: FULL port_type: ACCESS

the machine state and port state of the port are as the follow
mux_state: DETCH rcvm_state: P_DIS prm_state: NO_PER
actor_oper_port_state : L_A___F_
partner_oper_port_state: _TA___F_

port Ethernet0/0/2 :
both of the port and the agg attributes are not equal
the general information of the port are as follows:
portnumber: 2 actor_port_agg_id:0 partner_oper_sys:0x000000000000
partner_oper_key: 0x0002 actor_oper_port_key: 0x0102
mode of the port: ACTIVE lacp_aware: enable
begin: FALSE port_enabled: FALSE lacp_ena: TRUE ready_n: TRUE

the attributes of the port are as follows:
mac_type: ETH_TYPE speed_type: ETH_SPEED_100M
duplex_type: FULL port_type: ACCESS

the machine state and port state of the port are as the follow
mux_state: DETCH rcvm_state: P_DIS prm_state: NO_PER
actor_oper_port_state : L_A___F_
partner_oper_port_state: _TA___F_

Displayed information	Explanation
portnumber	Port number
actor_port_agg_id	The channel number to add the port to. If the port cannot be added to the channel due to inconsistent parameters between the port and the channel, 0 will be displayed.
partner_oper_sys	System ID of the other end.
partner_oper_key	Operational key of the other end.
actor_oper_port_key	Local end operational key
mode of the port	The mode in which port is added to the group
mac_type	Port type: standard Ethernet port and fiber-optical distributed data interface

speed_type	Port speed type: 10Mbps, 100Mbps
duplex_type	Port duplex mode: full-duplex and half-duplex
port_type	Port VLAN property: access port or trunk port
mux_state	Status of port binding status machine
rcvm_state	Status of port receiving status machine
prm_state	Status of port sending status machine

3. Display load balance information for port-group 1.
Switch# show port-group 1 load-balance
The loadbalance of the group 1 based on src MAC address.

4. Display member port information for port-group 1.
Switch# show port-group 1 port
Sorted by the ports in the group 1 :
---
the portnum is 1
port Ethernet0/0/1 related information:

Actor part

	Administrative	Operational
port number	1	
port priority	0x8000	
aggregator id	0	
port key	0x0100	0x0101
port state		
LACP activety	.	1
LACP timeout	.	.
Aggregation	1	1
Synchronization	.	.
Collecting	.	.
Distributing	.	.
Defaulted	1	1
Expired	.	.

Partner part

	Administrative	Operational
system	000000-000000	000000-000000
system priority	0x8000	0x8000
key	0x0001	0x0001
port number	1	1
port priority	0x8000	0x8000
port state		
LACP activety	.	.

LACP timeout 1 1
Aggregation 1 1
Synchronization . .
Collecting . .
Distributing . .
Defaulted 1 1
Expired . .

Selected Unselected

Displayed information	Explanation
portnumber	Port number
port priority	Port Priority
system	System ID
system priority	System Priority
LACP activety	Whether port is added to the group in ‘active’ mode, 1 for yes.
LACP timeout	Port timeout mode, 1 for short timeout.
Aggregation	Whether aggregation is possible for the port, 0 for independent port that does not allow aggregation.
Synchronization	Whether port is synchronized with the partner end.
Collecting	Whether status of port bound status machine is ‘collecting’ or not.
Distributing	Whether status of port bound status machine is ‘distributing’ or not.
Defaulted	Whether the local port is using default partner end parameter.
Expired	Whether status of port receiving status machine is ‘expire’ or not.
Selected	Whether the port is selected or not..

5．Display port-channel information for port-group1

```
Switch# show port-group 1 port-channel
Port channels in the group 1:
----------------------------------------------------
Port-Channel: port-channel1
Number of port : 2          Standby port : NULL

Port in the port-channel :

Index            Port              Mode
----------------------------------------------------
1                Ethernet0/0/1     active
2                Ethernet0/0/2     active
```

Displayed information	Explanation
Port channels in the group	If port-channel does not exist, the above information will not be displayed.
Number of port	Port number in the port-channel.
Standby port	Port that is in 'standby' status, which means the port is qualified to join the channel but cannot join the channel due to the maximum port limit, thus the port status is 'standby' instead of 'selected'.

17.4.1.2 debug lacp

Command: debug lacp
no debug lacp
Function: Enable the LACP debug function: '**no debug lacp'** command disables this debug function**.**
Command mode: Admin Mode
Default: LACP debug information is disabled by default.
Usage Guide: Use this command to enable LACP debugging so that LACP packet processing information can be displayed.
Example: Enable LACP debugSwitch#debug lacp

17.4.2 Port Channel Channel Troubleshooting

If problems occur when configuring port aggregation, please first check the following for causes.

- Ensure all ports in a port group have the same properties, i.e., whether they are in full-duplex mode, forced to the same speed, and have the same VLAN properties, etc. If inconsistency occurs, make corrections.
- Some commands cannot be used on a port in port-channel, such as arp, bandwidth, ip, ip-forward, etc.
- When port-channel is forced, as the aggregation is triggered manually, the port group will stay unaggregated if aggregation fails due to inconsistent VLAN information. Ports must be added to or removed from the group to trigger another aggregation, if VLAN information inconsistency persists, the aggregation will fail again. The aggregation will only succeed when VLAN information is consistent and aggregation is triggered due to port addition or removal.
- Verify that port group is configured in the partner end, and in the same configuration. If the local end is set in manual aggregation or LACP, the same should be done in the partner end; otherwise port aggregation will not work properly. Another thing to be noted is that if both ends are configured with LACP, then at least one of them should

be in ACTIVE mode, otherwise LACP packet won't be initiated.

- LACP cannot be used on ports with Security and IEEE 802.1x enabled.
- Once the port-channel created, all the configuration of the ports can only be applied to port-channel ports
- LACP should be mutually exclusive to Security and 802.1X ports, if a port has been configured with the two protocols above, the LACP is not allowed to be enabled.
- If anti-arpscan is enabled on the switch, the port should be configured as anti-arpscan trust supertrust port before it is configured as port channel. Otherwise, the switch may be stopped because of sending out too many ARP packets, and the port channel setup will fail.

Chapter 18 DHCP Configuration

18.1 Introduction to DHCP

DHCP [RFC2131] is the acronym for Dynamic Host Configuration Protocol. It is a protocol that assigns IP address dynamically from the address pool as well as other network configuration parameters such as default gateway, DNS server, and default route and host image file position within the network. DHCP is the enhanced version of BootP. It is a mainstream technology that can not only provide boot information for diskless workstations, but can also release the administrators from manual recording of IP allocation and reduce user effort and cost on configuration. Anther benefit of DHCP is it can partially ease the pressure on IP demands, when the user of an IP leaves the network that IP can be assigned to another user.

DHCP is a client-server protocol, the DHCP client requests the network address and configuration parameters from the DHCP server; the server provides the network address and configuration parameters for the clients; if DHCP server and clients are located in different subnets, DHCP relay is required for DHCP packets to be transferred between the DHCP client and DHCP server. The implementation of DHCP is shown below:

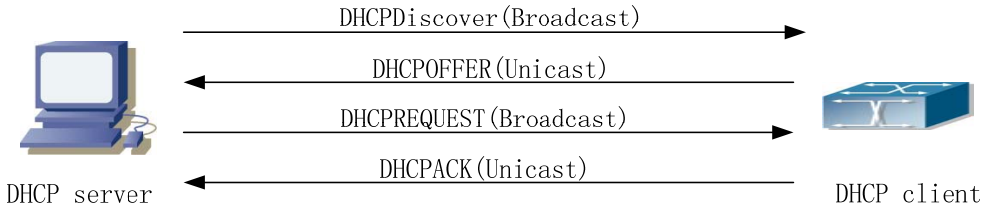


Fig 18-1 DHCP protocol interaction

Explanation:

1. DHCP client broadcasts DHCPDISCOVER packets in the local subnet.
2. On receiving the DHCPDISCOVER packet, DHCP server sends a DHCPOFFER packet along with IP address and other network parameters to the DHCP client.
3. DHCP client broadcast DHCPREQUEST packet with the information for the DHCP server it selected after selecting from the DHCPOFFER packets.
4. The DHCP server selected by the client sends a DHCPACK packet and the client gets an IP address and other network configuration parameters.

The above four steps finish a Dynamic host configuration assignment process. However, if the DHCP server and the DHCP client are not in the same network, the server will not receive the DHCP broadcast packets sent by the client, therefore no DHCP packets will be sent to the client by the server. In this case, a DHCP relay is required to

forward such DHCP packets so that the DHCP packets exchange can be completed between the DHCP client and server.

DCS-3950 series switch can act as both a DHCP server and a DHCP relay. DHCP server supports not only dynamic IP address assignment, but also manual IP address binding (i.e. specify a specific IP address to a specified MAC address or specified device ID over a long period. The differences and relations between dynamic IP address allocation and manual IP address binding are: 1) IP address obtained dynamically can be different every time; manually bound IP address will be the same all the time. 2) The lease period of IP address obtained dynamically is the same as the lease period of the address pool, and is limited; the lease of manually bound IP address is theoretically endless. 3) The IP addresses bound manually have higher priority than the IP addresses allocated dynamically. 4) Dynamic DHCP address pool can inherit the network configuration parameters of the dynamic DHCP address pool of the related segment.

18.2 DHCP Server Configuration

18.2.1 DHCP Sever Configuration Task List

1. Enable/Disable DHCP server
2. Configure DHCP Address pool
   (1) Create/Delete DHCP Address pool
   (2) Configure DHCP address pool parameters
   (3) Configure manual DHCP address pool parameters
3. Enable logging for address conflicts
4. Configure count of ping packets and out time

1. Enable/Disable DHCP server

Command	**Explanation**
Global Mode	
service dhcp **no service dhcp**	Enables DHCP server

2. Configure DHCP Address pool

(1) Create/Delete DHCP Address pool

Command	**Explanation**
Global Mode	
ip dhcp pool <*name*> **no ip dhcp pool <*name*>**	Configures DHCP Address pool

(2)Configure DHCP address pool parameters

Command	Explanation
DHCP Address Pool Mode	

network-address <*network-number*> [mask | prefix-length] **no network-address**	Configures the address scope that can be allocated to the address pool
default-router [address1[address2[…address8]]] **no default-router**	Configures default gateway for DHCP clients
dns-server [address1[address2[…address8]]] **no dns-server**	Configures DNS server for DHCP clients
domain-name <*domain*> **no domain-name**	Configures Domain name for DHCP clients; the '**no domain-name**' command deletes the domain name.
netbios-name-server [address1[address2[…address8]]] **no netbios-name-server**	Configures the address for WINS server
netbios-node-type {**b-node|h-node|m-node|p-node|<*type-number*>**} **no netbios-node-type**	Configures node type for DHCP clients
bootfile <*filename*> **no bootfile**	Configures the file to be imported for DHCP clients on boot up
next-server [address1[address2[…address8]]] **no next-server [address1[address2[…address8]]]**	Configures the address of the server hosting file for importing
option <*code*> {ascii <*string*> | hex <*hex*> | ipaddress <*ipaddress*>} **no option <*code*>**	Configures the network parameter specified by the option code
lease { days [hours][minutes] | infinite } **no lease**	Configures the lease period allocated to addresses in the address pool
Global Mode	
ip dhcp excluded-address <*low-address*> [<*high-address*>] **no ip dhcp excluded-address <*low-address*> [<*high-address*>]**	Excludes the addresses in the address pool that are not for dynamic allocation.

(3) Configure manual DHCP address pool parameters

Command	**Explanation**
DHCP Address Pool Mode	
hardware-address <*hardware-address*> [{Ethernet | IEEE802|<*type-number*>}] **no hardware-address**	Specifies the hardware address when assigning address manually

host <*address*> [<*mask*> | <*prefix-length*>] **no host**	Specifies the IP address to be assigned to the specified client when binding address manually
client-identifier <*unique-identifier*> **no client-identifier**	Specifies the unique ID of the user when binding address manually
client-name <*name*> **no client-name**	Configures a client name when binding address manually

3.Enable logging for address conflicts

Command	**Explanation**
Global Mode	
ip dhcp conflict logging **no ip dhcp conflict logging**	Enables logging for DHCP address to detect address conflicts
Admin Mode	
clear ip dhcp conflict <*address* | *all*>	Deletes a single address conflict record or all conflict records

4. Configure count of ping packets and out time

Command	**Explanation**
Global Mode	
ip dhcp ping packets <*count*> **no ip dhcp ping packets**	Configure count of ping packets to be be assigned in DHCP Address pool
ip dhcp ping timeout <*milliseconds*> **no ip dhcp ping timeout**	Configure timeout time after set ping packets to receive responses

18.2.2 DHCP Server Configuration Command List

18.2.2.1 bootfile

Command: bootfile <filename>

no bootfile

Function: Set the file name for DHCP client to import on boot up; the '**no bootfile** 'command deletes this setting.

Parameters: *<filename>* is the name of the file to be imported, up to 255 characters are allowed.

Command mode: DHCP Address Pool Mode

Usage Guide: Specify the name of the file to be imported for the client. This is usually used for diskless workstations that need to download a configuration file from the server on boot up. This command is together with the 'next sever'.

Example: The path and filename for the file to be imported is 'c:\temp\nos.img' .

Switch(dhcp-1-config)#bootfile c:\temp\nos.img

Related command: next-server

18.2.2.2 client-identifier

Command: client-identifier <unique-identifier>
no client-identifier
Function: Specify the unique ID of the user when binding an address manually; the '**no client-identifier**' command deletes the identifier.
Parameters: <*unique-identifier*> is the user identifier, in dotted Hex format.
Command mode: DHCP Address Pool Mode
Usage Guide: This command is used with 'host' when binding an address manually. If the requesting client identifier matches the specified identifier, DHCP server assigns the IP address defined in 'host' command to the client.
Example: Specify the IP address 10.1.128.160 to be bound to user with the unique id of 00-10-5a-60-af-12 in manual address binding.
Switch(dhcp-1-config)#client-identifier 00-10-5a-60-af-12
Switch(dhcp-1-config)#host 10.1.128.160 24
Related Commands：host

18.2.2.3 client-name

Command: client-name <name>
no client-name
Function: Specify the username when binding addresses manually; the '**no client-name**' command deletes the username.
Parameters: <*name*> is the name of the user, up to 255 characters are allowed.
Command mode: DHCP Address Pool Mode
Usage Guide: Configure a username for the manual binding device, domain should not be included when configuring username.
Example: Give the user, with unique id of 00-10-5a-60-af-12, a username of 'network'.
Switch(dhcp-1-config)#client-name network

18.2.2.4 default-router

Command: default-router <address1>[<address2>[…<address8>]]
no default-router
Function: Configure default gateway(s) for DHCP clients; the '**no default-router**' command deletes the default gateway.
Parameters: *address1…address8* are IP addresses, in decimal format.
Default: No default gateway is configured for DHCP clients by default.
Command mode: DHCP Address Pool Mode
Usage Guide: The IP address of default gateway(s) should be in the same subnet as the DHCP client IP, the switch supports up to 8 gateway addresses. The gateway address assigned first has the highest priority, and therefore address1 has the highest priority, and address2 has the second, and so on.
Example: Configure the default gateway for DHCP clients to be 10.1.128.2 and

10.1.128.100.
Switch(dhcp-1-config)#default-router 10.1.128.2 10.1.128.100

18.2.2.5 dns-server

Command: dns-server <address1>[<address2>[…<address8>]]
no dns-server
Function: Configure DNS servers for DHCP clients; the '**no dns-server**' command deletes the default gateway.
Parameters: ***address1…address8*** are IP addresses, in decimal format.
Default: No DNS server is configured for DHCP clients by default.
Command mode: DHCP Address Pool Mode
Usage Guide: Up to 8 DNS server addresses can be configured. The DNS server address assigned first has the highest priority, Therefore address 1 has the highest priority, and address 2 has the second, and so on.
Example: Set 10.1.128.3 as the DNS server address for DHCP clients.
Switch(dhcp-1-config)#dns-server 10.1.128.3

18.2.2.6 domain-name

Command: domain-name <domain>
no domain-name
Function: Configure the Domain name for DHCP clients; the '**no domain-name**' command deletes the domain name.
Parameters: ***<domain>*** is the domain name, up to 255 characters are allowed.
Command mode: DHCP Address Pool Mode
Usage Guide: Specifies a domain name for the client.
Example: Specify 'digitalchina.com.cn' as the DHCP clients' domain name.
Switch(dhcp-1-config)#domain-name digitalchina.com.cn

18.2.2.7 hardware-address

Command: hardware-address<*hardware-address*> [{Ethernet| IEEE802|<*type-number*>}]
no hardware-address
Function: Specify the hardware address of the user when binding address manually; the '**no hardware-address**' command deletes the setting.
Parameters: ***<hardware-address>*** is the hardware address in Hex; **Ethernet | IEEE802** is the Ethernet protocol type, ***<type-number>*** should be the RFC number defined for protocol types, from 1 to 255, e.g., 0 for Ethernet and 6 for IEEE 802.
Default: The default protocol type is Ethernet,
Command mode: DHCP Address Pool Mode
Usage Guide: This command is used with the 'host' when binding address manually. If the requesting client hardware address matches the specified hardware address, the

DHCP server assigns the IP address defined in 'host' command to the client.
Example: Specify IP address 10.1.128.160 to be bound to the user with hardware address 00-00-e2-3a-26-04 in manual address binding.
Switch(dhcp-1-config)#hardware-address 00-00-e2-3a-26-04
Switch(dhcp-1-config)#host 10.1.128.160 24
Related Command：host

18.2.2.8 host

Command: host <address> [<mask> | <prefix-length>]
no host
Function: Specify the IP address to be assigned to the user when binding addresses manually; the '**no host**' command deletes the IP address.
Parameters: *<address>* is the IP address in decimal format; ***<mask>*** is the subnet mask in decimal format; ***<prefix-length>*** means mask is indicated by prefix. For example, mask 255.255.255.0 in prefix is '24', and mask 255.255.255.252 in prefix is '30'.
Command mode: DHCP Address Pool Mode
Usage Guide: If no mask or prefix is configured when configuring the IP address, and no information in the IP address pool indicates anything about the mask, the system will assign a mask automatically according to the IP address class.
This command is used with 'hardware-address' command or 'client-identifier' command when binding addresses manually. If the identifier or hardware address of the requesting client matches the specified identifier or hardware address, the DHCP server assigns the IP address defined in 'host' command to the client.
Example: Specify IP address 10.1.128.160 to be bound to user with hardware address 00-10-5a-60-af-12 in manual address binding.
Switch(dhcp-1-config)#hardware-address 00-10-5a-60-af-12
Switch(dhcp-1-config)#host 10.1.128.160 24
Related command：hardware-address、client-identifier

18.2.2.9 ip dhcp conflict logging

Command: ip dhcp conflict logging
no ip dhcp conflict logging
Function: Enable logging for address conflicts detected by the DHCP server; the '**no ip dhcp conflict logging'** command disables the logging.
Default: Logging for address conflict is enabled by default.
Command mode: Global Mode
Usage Guide: When logging is enabled, once the address conflict is detected by the DHCP server, the conflicting address will be logged. Addresses present in the log for conflicts will not be assigned dynamically by the DHCP server until the conflicting records are deleted.
Example: Disable logging for DHCP server.
Switch(Config)#no ip dhcp conflict logging

Related commands：clear ip dhcp conflict

18.2.2.10 ip dhcp excluded-address

Command: ip dhcp excluded-address <low-address>[<high-address>]
no ip dhcp excluded-address <low-address> [<high-address>]
Function: Specify addresses excluding from dynamic assignment; the '**no ip dhcp excluded-address <*low-address*> [<*high-address*>]**' command cancels the setting.
Parameters: <*low-address*> is the starting IP address, **[<*high-address*>]** is the ending IP address.
Default: Only individual address is excluded by default.
Command mode: Global Mode
Usage Guide: This command can be used to exclude one or several consecutive addresses in the pool from being assigned dynamically so that those addresses can be used by the administrator for other purposes.
Example: Reserve addresses from 10.1.128.1 to 10.1.128.10 from dynamic assignment.
Switch(Config)#ip dhcp excluded-address 10.1.128.1 10.1.128.10

18.2.2.11 ip dhcp pool

Command: ip dhcp pool <name>
no ip dhcp pool <name>
Function: Configure a DHCP address pool and enter the pool mode; the '**no ip dhcp pool <*name*>'** command deletes the specified address pool.
Parameters: <*name*> is the address pool name, up to 255 characters are allowed.
Command mode: Global Mode
Usage Guide: This command is used to configure a DHCP address pool under Global Mode and enter the DHCP address configuration mode.
Example: Define an address pool named '1'.
Switch(Config)#ip dhcp pool 1
Switch(dhcp-1-config)#

18.2.2.12 ip dhcp ping packets

Command：**ip dhcp ping packets <*count*>**
no ip dhcp ping packets
Function: Specify the number of ping packets the DHCP Server sends to a pool address before assigning the address to a requesting client. If no is put in front of the command, settings will be removed.
Parameters: <count> is the number of ping packets to be sent. Its value is limited between 0 and 10.
Default: The default is two packets.
Command mode: Global Mode.

Usage Guide: To configure the number of ping packets to be sent. The default is two packets.
Example: Configure number of ping packets to be 5.
Switch(Config)#ip dhcp ping packets 5
Releated Commands: ip dhcp ping timeout

18.2.2.13 ip dhcp ping timeout

Command: ip dhcp ping timeout *<milliseconds>*
no ip dhcp ping timeout
Function: Specify the amount of time the DHCP Server must wait before timing out a ping packet. If no is put in front of the command, settings will be removed.**Parameters: *<milliseconds>*** is the time out value, in milliseconds, with limitation between 100 and 10000.
Default: The default is 500 milliseconds.
Command mode: Global Mode.
Usage Guide: This command is used to configure the time out for ping packets. If the DHCP server can not get ping echos with in the specified time, it will consider the address as unused, and will assign this IP address to a new client. If ping echos can be received, the IP address will be recorded in the conflict logs.
Defaut: Modify the time out to be 1 second.
Switch(Config)#ip dhcp ping timeout 1000
Related Commands: ip dhcp ping packets

18.2.2.14 loghost dhcp

Command: loghost dhcp <ip-address> <port>
no loghost dhcp
Function: Enable DHCP logging and specify the IP address and port number for the DHCP logging host; the '**no loghost dhcp'** command disables the DHCP logging function.
Parameters: *<ip-address>* is the DHCP log host IP address in decimal format. ***<port>*** is the port number, valid values range from 0 -65535.
Default: DHCP logging is disabled by default.
Command mode: Global Mode
Usage Guide: If this command is configured on the switch, log can be generated Use this command to enable LACP debugging so that LACP packet processing information can be displayed.
Example: Enable LACP debug
Switch(Config)#loghost dhcp 192.168.1.101 45

18.2.2.15 lease

Command: lease (infinite | <0-365>days (<0-23>hours (<0-59>minutes|)|))
no lease

Function: Set the lease time for addresses in the address pool; the '**no lease**' command restores the default setting.
Parameters: ***<days>*** is number of days from 0 to 365; ***<hours>*** is number of hours from 0 to 23; ***<minutes>*** is number of minutes from 0 to 59; **infinite** means perpetual use.
Default: The default lease duration is 1 day.
Command mode: DHCP Address Pool Mode
Usage Guide: DHCP is the protocol to assign network addresses dynamically instead of permanently, hence the introduction of ease duration. Lease settings should be decided based on network conditions: too long lease duration offsets the flexibility of DHCP, while too short duration results in increased network traffic and overhead.
Example: Set the lease of DHCP pool '1' to 3 days 12 hours and 30 minutes.
Switch(dhcp-1-config)#lease 3 12 30

18.2.2.16 netbios-name-server

Command: netbios-name-server <address1>[<address2>[…<address8>]]
no netbios-name-server
Function: Configure WINS servers' address; the '**no netbios-name-server**' command deletes the WINS server.
Parameters: ***address1…address8*** are IP addresses, in decimal format.
Default: No WINS server is configured by default.
Command mode: DHCP Address Pool Mode
Usage Guide: This command is used to specify WINS server for the client, up to 8 WINS server addresses can be configured. The WINS server address assigned first has the highest priority. Therefore, address 1 has the highest priority, and address 2 the second, and so on.

18.2.2.17 netbios-node-type

Command: netbios-node-type {b-node|h-node|m-node|p-node|<type-number>}
no netbios-node-type
Function: Set the node type for the specified port; the '**no netbios-node-type**' command cancels the setting.
Parameters: b-node stands for broadcasting node, **h-node** for hybrid node that broadcasts after point-to-point communication; **m-node** for hybrid node to communicate in point-to-point after broadcast; **p-node** for point-to-point node; ***<type-number>*** is the node type in Hex from 0 to FF.
Default: No client node type is specified by default.
Command mode: DHCP Address Pool Mode
Usage Guide: If client node type is to be specified, it is recommended to set the client node type to h-node that broadcasts after point-to-point communication.
Example: Set the node type for client of pool 1 to broadcasting node.
Switch(dhcp-1-config)#netbios-node-type b-node

18.2.2.18 network-address

Command: network-address <network-number> [<mask> | <prefix-length>]
no network-address
Function: Set the scope for assignment for addresses in the pool; the '**no network-address**' command cancels the setting.
Parameters: <*network-number*> is the network number; **<*mask*>** is the subnet mask in the decimal format; **<*prefix-length*>** stands for mask in prefix form. For example, mask 255.255.255.0 in prefix is '24', and mask 255.255.255.252 in prefix is '30'. Note: When using DHCP server, the pool mask should be longer or equal to that of layer 3 interface IP address in the corresponding segment.
Default: If no mask is specified, default mask will be assigned according to the address class.
Command mode: DHCP Address Pool Mode
Usage Guide: This command sets the scope of addresses that can be used for dynamic assignment by the DHCP server; one address pool can only have one corresponding segment. This command is exclusive with the manual address binding command 'hardware address' and 'host'.
Example: Configure the assignable address in pool 1 to be 10.1.128.0/24.
Switch(dhcp-1-config)#network-address 10.1.128.0 24
Related Commands: ip dhcp excluded-address

18.2.2.19 next-server

Command: next-server <address1>[<address2>[…<address8>]]
no next-server
Function: Set the server address for storing the client import file; the '**no next-server**' command cancels the setting.
Parameters: *address1…address8* are IP addresses, in the decimal format.
Command mode: DHCP Address Pool Mode
Usage Guide: To specify the server address where the import file is stored for the client. For thin client workstation, the workstation has to download the configuration file form the server.
Example: Specify the server address to be 10.1.128.4.
Switch(dhcp-config)#next-server 10.1.128.4
Related Commands: bootfile

18.2.2.20 option

Command: option <code> {ascii <string> | hex <hex> | ipaddress <ipaddress>}
no option <code>
Function: Set the network parameter specified by the option code; the '**no option <*code*>**' command cancels the setting for option.
Parameters: <*code*> is the code for network parameters; **<*string*>** is the ASCII string up

to 255 characters; ***<hex>*** is a value in Hex that is no greater than 510 and must be of even length; ***<ipaddress>*** is the IP address in decimal format, up to 63 IP addresses can be configured.
Command mode: DHCP Address Pool Mode
Usage Guide: The switch provides common commands for network parameter configuration as well as various commands useful in network configuration to meet different user needs. The definition of option code is described in detail in RFC2123.
Example: Set the WWW server address as 10.1.128.240. Switch(dhcp-1-config)#option 72 ip 10.1.128.240

18.2.2.21 service dhcp

Command: service dhcp
no service dhcp
Function: Enable DHCP server; the '**no service dhcp**' command disables the DHCP service.
Default: DHCP service is disabled by default.
Command mode: Global Mode
Usage Guide: Both DHCP server and DHCP relay are included in the DHCP service. When DHCP services are enabled, both DHCP server and DHCP relay are enabled.
Example: Enable DHCP server.
Switch(Config)#service dhcp

18.2.3 DHCP Server Configuration Example

Scenario :
To save configuration efforts of network administrators and users, a company is using DCS-3950 series switch as a DHCP server. The Admin VLAN IP address is 10.16.1.2/24. The local area network for the company is divided into network A and B according to the office locations. The network configurations for location A and B are shown below.

PoolA(network 10.16.1.0)		PoolB(network 10.16.2.0)	
Device	IpAddress	Device	IpAddress
Default Gateway	10.16.1.200 10.16.1.201	Default Gateway	10.16.2.200 10.16.2.201
DNSServer	10.16.1.202	DNSServer	10.16.2.202
WinsServer	10.16.1.209	WWWServer	10.16.2.209
WinsNode Type	H-node		
Lease	3Days	Lease	1Day

In location A, a machine with MAC address 00-03-22-23-dc-ab is assigned with a fixed IP address of 10.16.1.210 and named as 'management'.
Switch(Config)#interface vlan 1
Switch(Config-If-Vlan1)#ip address 10.16.1.2 255.255.255.0
Switch(Config--If-Vlan1)#exit

```
Switch(Config)#ip dhcp pool A
Switch(dhcp-A-config)#network-address 10.16.1.0 24
Switch(dhcp-A-config)#lease 3
Switch(dhcp-A-config)#default-route 10.16.1.200 10.16.1.201
Switch(dhcp-A-config)#dns-server 10.16.1.202
Switch(dhcp-A-config)#netbios-name-server 10.16.1.209
Switch(dhcp-A-config)#netbios-node-type H-node
Switch(dhcp-A-config)#exit
Switch(Config)#ip dhcp excluded-address 10.16.1.200 10.16.1.210
Switch(Config)#ip dhcp pool B
Switch(dhcp-B-config)#network-address 10.16.2.0 24
Switch(dhcp-B-config)#lease 1
Switch(dhcp-B-config)#default-route 10.16.2.200 10.16.2.201
Switch(dhcp-B-config)#dns-server 10.16.2.202
Switch(dhcp-B-config)#option 72 ip 10.16.2.209
Switch(dhcp-config)#exit
Switch(Config)#ip dhcp excluded-address 10.16.2.200 10.16.2.210
Switch(Config)#ip dhcp pool A1
Switch(dhcp-A1config)#host 10.16.1.210
Switch(dhcp-A1-config)#hardware-address 0003.2223.dcab
Switch(dhcp-A1-config)#    client-name management
Switch(dhcp-A1-config)#exit
```

Usage Guide: When a DHCP/BootP client is connected to a VLAN1 port of the switch, the client can only get its address from 10.16.1.0/24 instead of 10.16.2.0/24. This is because the broadcast packet from the client will be requesting the IP address in the same segment of the VLAN interface after VLAN interface forwarding, and the VLAN interface IP address is 10.16.1.2/24, therefore the IP address assigned to the client will belong to 10.16.1.0/24.

If the DHCP/BootP client wants to have an address in 10.16.2.0/24, the gateway forwarding broadcast packets of the client must belong to 10.16.2.0/24. The connectivity between the client gateway and the switch must be ensured for the client to get an IP address from the 10.16.2.0/24 address pool.

18.3 DHCP Troubleshooting

18.3.1 Monitor and Debug Command List

18.3.1.1 clear ip dhcp binding

Command：clear ip dhcp binding {<address> | all }

Function: Delete the specified IP address-hardware address binding record or all IP address-hardware address binding records.

Parameters: <*address*> is the IP address that has a binding record in decimal format. **all** refers to all IP addresses that have a binding record.
Command mode: Admin Mode
Usage Guide: 'show ip dhcp binding' command can be used to view binding information for IP addresses and corresponding DHCP client hardware addresses. If the DHCP server is informed that a DHCP client is not using the assigned IP address for some reason before the lease period expires, the DHCP server would not remove the binding information automatically. The system administrator can use this command to delete that IP address-client hardware address binding manually, if 'all' is specified, then all auto binding records will be deleted, thus all addresses in the DHCP address pool wil be reallocated.
Example: Remove all IP-hardware address binding records.
Switch#clear ip dhcp binding all
Relative Command：show ip dhcp binding

18.3.1.2 clear ip dhcp conflict

Command：clear ip dhcp conflict {<address> | all }
Function: Delete an address present in the address conflict log.
Parameters: <*address*> is the IP address that has a conflict record; **all** stands for all addresses that have conflict records.
Command mode: Admin Mode
Usage Guide: 'show ip dhcp conflict' command can be used to check which IP addresses are conflicting for use. The 'clear ip dhcp conflict' command can be used to delete the conflict record for an address. If 'all' is specified, then all conflict records in the log will be removed. When records are removed from the log, the addresses are available for allocation by the DHCP server.
Example: The network administrator finds 10.1.128.160 that has a conflict record in the log and is no longer used by anyone, so he deletes the record from the address conflict log.
Switch#clear ip dhcp conflict 10.1.128.160
Relative Command：ip dhcp conflict logging，show ip dhcp conflict

18.3.1.3 clear ip dhcp server statistics

Command：clear ip dhcp server statistics
Function: Delete the statistics for DHCP server, clears the DHCP server count.
Command mode: Admin Mode
Usage Guide： DHCP server counter statistics can be displayed with this command, and the statistics in summary. The counters can be reset with this command.
Example: Reset the counters of the DHCP server.
Switch#clear ip dhcp server statistics
Relative Command：show ip dhcp server statistics

18.3.1.4 show ip dhcp binding

Command：show ip dhcp binding
Function: Display IP-MAC binding information.
Command mode: Admin Mode
Example:
Switch#sh ip dhcp binding

IP address	Hardware adress	Lease expiration	Type
10.1.1.233	00-00-E2-3A-26-04	Infinite	Manual
10.1.1.254	00-00-E2-3A-5C-D3	60	Automatic

Displayed information	Explanation
IP address	IP address assigned to a DHCP client
Hardware address	MAC address of a DHCP client
Lease expiration	Valid time for the DHCP client to hold the IP address
Type	Type of assignment: manual binding or dynamic assignment.

18.3.1.5 show ip dhcp conflict

Command：show ip dhcp conflict
Function: Display log information for addresses that have a conflict record.
Command mode: Admin Mode
Example:
Switch#sh ip dhcp conflict

IP Address	Detection method	Detection Time
10.1.1.1	Ping	FRI JAN 02 00:07:01 2002

Displayed information	Explanation
IP Address	Conflicting IP address
Detection method	Method in which the conflict is detected.
Detection Time	Time when the conflict is detected.

18.3.1.6 show ip dhcp server statistics

Command: show ip dhcp server statistics
Function: Display statistics of all DHCP packets for a DHCP server.
Command mode: Admin Mode
Example:
Switch#sh ip dhcp server statistics

Memory usage	389
Address pools	3
Database agents	0

```
Automatic bindings          2
Manual bindings             0
Conflict bindings           0
Expiried bindings           0
Malformed message           0

Message                     Recieved
BOOTREQUEST                 3814
DHCPDISCOVER                1899
DHCPREQUEST                 6
DHCPDECLINE                 0
DHCPRELEASE                 1
DHCPINFORM                  1

Message                     Send
BOOTREPLY                   1911
DHCPOFFER                   6
DHCPACK                     6
DHCPNAK                     0
DHCPRELAY                   1907
DHCPFORWARD                 0
Switch#
```

Displayed information	Explanation
Memory usage	using rate of EMS memory
Address pools	Number of DHCP address pools configured.
Database agents	Number of database agents.
Automatic bindings	Number of addresses assigned automatically
Manual bindings	Number of addresses bound manually
Conflict bindings	Number of conflicting addresses
Expiried bindings	Number of addresses whose leases are expired
Malformed message	Number of error messages.
Message Recieved	Statistics for DHCP packets received
BOOTREQUEST	Total packets received
DHCPDISCOVER	Number of DHCPDISCOVER packets
DHCPREQUEST	Number of DHCPREQUEST packets
DHCPDECLINE	Number of DHCPDECLINE packets
DHCPRELEASE	Number of DHCPRELEASE packets
DHCPINFORM	Number of DHCPINFORM packets
Message Send	Statistics for DHCP packets sent
BOOTREPLY	Total packets sent
DHCPOFFER	Number of DHCPOFFER packets
DHCPACK	Number of DHCPACK packets
DHCPNAK	Number of DHCPNAK packets

DHCPRELAY	Number of DHCPRELAY packets
DHCPFORWARD	Number of DHCPFORWARD packets

18.3.1.7 debug ip dhcp server

Command：debug ip dhcp server { events|linkage|packets }
no debug ip dhcp server { events|linkage|packets }
Function: Enable DHCP server debug information: the '**no debug ip dhcp server { events|linkage|packets }'** command disables the debug information for DHCP server**.**
Default: Debug information is disabled by default.
Command mode: Admin Mode

18.3.1.8 debug ip dhcp client

Command：debug ip dhcp cliet { events|packets }
no debug ip dhcp cliet { events|packets }
Function: Enable DHCP server debug information: the '**no debug ip dhcp cliet { events|packets }** 'command command disables the debug information for DHCP server**.**
Default: Debug information is disabled by default.
Command mode: Admin Mode

18.3.2 DHCP Troubleshooting

If the DHCP clients cannot obtain IP addresses and other network parameters, the following procedures can be followed when DHCP client hardware and cables have been verified ok.

- Verify the DHCP server is running, start the related DHCP server if not running.
- If the DHCP clients and servers are not in the same physical network, verify the router responsible for DHCP packet forwarding has DHCP relay function. If DHCP relay is not available for the intermediate router, it is recommended to replace the router or upgrade its software to one that has a DHCP relay function.
- In such case, DHCP server should be examined for an address pool that is in the same segment of the switch VLAN, such a pool should be added if not present, and (This does not indicate DCS-3950 series switch cannot assign IP address for different segments, see solution 2 for details.)
- In DHCP service, pools for dynamic IP allocation and manual binding are conflicting, i.e., if command '**network-address**' and '**host**' are run for a pool, only one of them will take effect; furthermore, in manual binding, only one IP-MAC binding can be configured in one pool. If multiple bindings are required, multiple manual pools can be created and IP-MAC bindings set for each pool. New configuration in the same pool overwrites the previous configuration.

Chapter 19 DHCP Snooping Configuration

19.1 DHCP Snooping Introduction

DHCP Snooping can effectively block attacks from fake DHCP servers.

Defense against Fake DHCP Server：once the switch intercepts the DHCP server reply packets from un-trusted ports（including DHCPOFFER, DHCPACK, and DHCPNAK）, it will alarm the users and respond according to the situation（shutdown the port or send BlackHole）。

Defense against DHCP over load attacks：To avoid too many DHCP messages attacking CPU, users should limit the speed of DHCP to receive packets on trusted and un-trusted ports.

Record the binding data of DHCP：DHCP SNOOPING will record the binding data of DHCP SERVER while forwarding DHCP messages, it can also upload the binding data to the specified server to backup it. The binding data is mainly used to configure the dynamic users of dot1x userbased ports. Please refer to the chapter named 'dot1x configuration' to find more about the usage of dot1x userbased mode.

Add binding ARP: DHCP SNOOPING can add static binding ARP according to the binding data after capturing binding data, thus to avoid ARP cheating.

Add trusted users：DHCP SNOOPING can add trusted user list entries according to the parameters in binding data after capturing binding data; thus these users can access all resources without DOT1X authentication.

Automatic Recovery：A while after the switch shut down the port or sent blockhole, it should automatically recover the communication of the port or source MAC and send information to Log Server via syslog

LOGF Function：When the switch discovers abnormal received packets or automatically recovers, it should send syslog information to Log Server

19.2 DHCP Snooping Configuration

19.2.1 DHCP Snooping Configuration Task List

1. Enable DHCP Snooping
2. Enable the binding function of DHCP Snooping
3. Enable ARP binding for DHCP snooping.
4. Configure helper server address
5. Configure trusted ports

6. Enable dot1x binding for DHCP snooping.
7. Enable user binding for DHCP snooping.
8. Add static binding entries
9. Configure defense action
10. Enable DHCP Snooping option 82 function
11. Enable debugging.
12. Set log record

1. Enable DHCP Snooping

Command	Explanation
Global configuration mode	
Ip dhcp snooping enable **no Ip dhcp snooping enable**	Enable or disable dhcp snooping function

2. Enable the binding function of DHCP Snooping

Command	Explanation
Global configuration mode	
Ip dhcp snooping binding enable **no Ip dhcp snooping binding enable**	Enable or disable the binding function of dhcp snooping

3. Configure address for the helper server.

Commands	Explanation
Global Mode	
ip user helper-address A.B.C.D [port <*udpport*>] source <*ipAddr*> [secondary] **no Ip user helper-address [secondary]**	Configure/Remove the address for help server.

4. Enable ARP binding for DHCP Snooping.

Commands:	Explanation
Global Mode	
Ip dhcp snooping binding arp **no Ip dhcp snooping binding arp**	Enable/Disable ARP binding for DHCP Snooping.

5. Set trusted ports

Command	Explanation
Port configuration mode	
Ip dhcp snooping trust **no Ip dhcp snooping trust**	Set or delete the dhcp snooping trust attributes of the port.

6 Enable DOT1X binding for DHCP Snooping.

Commands	Explanation
Port Mode.	
Ip dhcp snooping binding dot1x **no Ip dhcp snooping binding dot1x**	Enable/Disable the dot1x binding for DHCP snooping.

7. Enable user binding for DHCP snooping.

Command	Explanation
Port Mode	
Ip dhcp snooping binding user-control **no Ip dhcp snooping binding user-control**	Enable/Disable user binding for DHCP snooping.

8. Add static binding entries.

Command	Explanation
Global Mode	
Ip dhcp snooping binding user <*mac*> address <*ipAddr*> <*mask*> vlan <*vid*> interface [ethernet] <ifname> **no Ip dhcp snooping binding user <*mac*> interface [ethernet] <*ifname*>**	Add/Remove static binding for DHCP snooping.

9. Configure defense action

Command	Explanation
Port configuration mode	
ip dhcp snooping action {shutdown|blackhole} [recovery <second>] **no ip dhcp snooping action**	Set or delete the automatic defense action of the port.

10 Enable DHCP Snooping option 82 function

Command	Explanation
Global Mode	
ip dhcp snooping information enable **no ip dhcp snooping information enable**	Enable or close dhcp snooping option82.

11. Enable the debug switch

Command	Explanation
Admin Mode	

Debug ip dhcp snooping packet **Debug ip dhcp snooping event** **Debug ip dhcp snooping update** **Debug ip dhcp snooping binding**	Please refer to the system debugging chapter.

12. Set log record

Command	Explanation
Admin Mode	
Login on **logging source {default|** **m_shell|sys_event|anti_attack} channel** **{ console | logbuff | loghost | monitor }** **[level { critical | debugging | notifications |** **warnings } [state { on | off }]]**	Please refer to the chapter on system log

19.2.2 DHCP Snooping Command List

19.2.2.1 ip dhcp snooping

Command：ip dhcp snooping enable
no ip dhcp snooping enable
Function： Enable the DHCP Snooping function.
Parameters：None.
Command mode：Globe Mode.
Default Settings：DHCP Snooping is disabled by default.
Usage Guide： When this function is enabled, it will monitor all the DHCP Server packets of non-trusted ports.
Example：Enable the DHCP Snooping function.
Switch(Config)#ip dhcp snooping enable

19.2.2.2 ip dhcp snooping binding

Command：debug ip dhcp snooping binding
no debug ip dhcp snooping binding
Function：This command is use to enable the DHCP SNOOPING debug switch to debug the state of binding data of DHCP SNOOPING.
Command mode：Admin Mode.
Default : DHCP snooping binding disabled by default
Usage Guide：This command is mainly used to debug the state of DHCP SNOOPING task when it adds ARP list entries, dot1x users and trusted user list entries according to binding data.
Example: Enable binding for DHCP snooping.

Switch(Config)#ip dhcp snooping binding enable

Related Commands: ip dhcp snooping enable

19.2.2.3 ip dhcp snooping binding user

Command：ip dhcp snooping binding user <mac> address <ipAddr> <mask> vlan <vid> interface [Ethernet] <ifname>

no Ip dhcp snooping binding user <mac> interface [Ethernet] <ifname>

Function： Configure the information of static binding users

Parameters：

mac：The MAC address of the static binding user, which is the only index of the binding user.

ipAddr、mask：The IP address and mask of the static binding user;

vid：The VLAN ID which the static binding user belongs to；

ifname：The access interface of static binding user

Command mode：Globe Mode.

Default：DHCP Snooping has no static binding list entry by default.

Usage Guide： The static binding users is deal in the same way as the dynamic binding users captured by DHCP SNOOPING; the follwoing actions are all allowed: notifying DOT1X to be a controlled user of DOT1X, adding a trusted user list entry directly, adding a bingding ARP list entry. The static binding uses will never be aged, and have a priority higher than dynamic binding users. Only after the DHCP SNOOPING binding function is enabled, the static binding users can be enabled.

Example：Configure static binding users

Switch(Config)#ip dhcp snooping binding user 00-03-0f-12-34-56 address 192.168.1.16 255.255.255.0 vlan 1 interface Ethernet0/0/16

Related Commands: ip dhcp snooping binding enable

19.2.2.4 ip dhcp snooping binding arp

Command：ip dhcp snooping binding arp

no ip dhcp snooping binding arp

Function： Enable the DHCP Snooping binding ARP funciton.

Parameters：None

Command mode：Globe Mode

Default： DHCP Snooping binding ARP funciton is disabled by default.

Usage Guide： When this function is enbaled, DHCP SNOOPING will add binding ARP list entries according to binding information. Only after the binding function is enabled can the binding ARP function be enabled. Binding ARP list entries are static entries without configuration of reservation, and will be added to the NEIGHBOUR list directly. The priority of binding ARP list entries is lower than the static ARP list entries set by administrator and can be overwritten by static ARP list entries. However, if the static ARP list entries has been removed, binding ARP list entries can not be recovered until DHCP SNOOPING recapture the biding inforamtion. Adding binding ARP list entries is used to

prevent these lists entried from being attacked by ARP cheating. At the same time, these static list entries need no reauthenticaiton, which can prenvent the switch from the failing to reauthenticate ARP when it is being attacked by ARP scanning. Only after the DHCP SNOOPING binding function is enabled, the binding ARP function can be set.

Example: Enable ARP binding for DHCP snooping.

Switch(Config)#ip dhcp snooping binding arp

Related Commands: ip dhcp snooping binding enable

19.2.2.5 ip dhcp snooping binding dot1x

Command：ip dhcp snooping binding dot1x

no ip dhcp snooping binding dot1x

Function： Enable the DHCP Snooping binding DOT1X funciton.

Parameters：None

Command mode：Port Mode

Default：By default, the binding DOT1X funciton is disabled on all ports. Usage Guide：When this function is enabled, DHCP SNOOPING will notify the DOT1X module about the captured bindng information as a DOT1X controlled user. This command is mutually exclusive to'ip dhcp snooping binding user-contro'command.

Only after the DHCP SNOOPING binding function is enabled, the binding ARP function can be set.

Example：Enable the binding DOT1X funciton on port ethernet0/0/1

Switch(Config)#interface ethernet 0/0/1

Switch(Config- Ethernet 0/0/1)# ip dhcp snooping binding dot1x

Related Commands: ip dhcp snooping binding enable

ip dhcp snooping binding user-control

19.2.2.6 ip dhcp snooping binding user-control

Command：ip dhcp snooping binding user-control

no ip dhcp snooping binding user-control

Function： Enable the binding user function

Parameters：None

Command mode：Port Mode

Default：By default, the binding user funciton is disabled on all ports.

Usage Guide： When this function is enabled, DHCP SNOOPING will treat the captured binding information as trusted users allowed to access all resources. This command is mutually exclusive with ip dhcp snooping binding dot1x.

Example: Enable user binding for ethernet 0/0/1

Switch(Config)#interface ethernet 0/0/1

Switch(Config- Ethernet 0/0/1)# ip dhcp snooping binding user-control

Releated Commands: ip dhcp snooping binding enable

ip dhcp snooping binding dot1x

19.2.2.7 ip dhcp snooping trust

Command：ip dhcp snooping trust
no ip dhcp snooping trust
Function： Set or delete the DHCP Snooping trust attributes of a port.
Parameters：None
Command mode：Port Mode
Default：By default, all ports are non-trusted ports
Usage Guide：Only when DHCP Snooping is globally enabled, can this command be set. When a port turns into a trusted port from a non-trusted port, the original defense action of the port will be automatically deleted; all the security history records will be cleared (except the information in system log).
Example：Set port ethernet 0/0/1 as a DHCP Snooping trusted port
Switch(Config)#interface ethernet 0/0/1
Switch(Config- Ethernet 0/0/1)#ip dhcp snooping trust

19.2.2.8 ip dhcp snooping action

Command：ip dhcp snooping action {shutdown|blackhole} [recovery <second>]
no ip dhcp snooping action
Function： Set or delete the automatic defense action of a port.
Parameters：
shutdown: When the port detects a fake DHCP Server, it will be shutdown.
blackhole： When the port detects a fake DHCP Server, the vid and source MAC of the fake packet will be used to block the traffic from this MAC.
Recovery ： Users can set to recover after the automatic defense action being executed.(no shut ports or delete correponding blackhole）
Second： Users can set how long after the execution of defense action to recover. The unit is second, and valid range is 10-3600.
Command mode：Port Mode
Default：No default defense action.
Usage Guide：Only when DHCP Snooping is globally enabled, can this command be set. Trusted port will not detect fake DHCP Server, so, will never trigger the corresponding defense action. When a port turns into a trusted port from a non-trusted port, the original defense action of the port will be automatically deleted.
Example：Set the DHCP Snooping defense action of port ethernet0/0/1 as setting blackhole, and the recovery time is 30 seconds.
Switch(Config)#interface ethernet 0/0/1
Switch(Config- Ethernet 0/0/1)#ip dhcp snooping action blackhole recovery 30

19.2.2.9 ip dhcp snooping action MaxNum

Command：ip dhcp snooping action {<maxNum>|default}
Function： Set the number of defense action that can be simultaneously taken effect.

Parameters：

<maxNum>: the number of defense action on each port, the range of which is 1-200, and the value of which is 10 by default

default：recover to the default value.

Command mode：Globe Mode.

Default：The default value is 10.

Usage Guide：Set the max number of defense actions to avoid the resource exhaustion of the switch caused by attacks. If the number of alarm information is larger than the set value, then the earliest defense action will be recovered forcibly in order to send new defense actions.

Example：Set the number of port defense actions as 100.

Switch(Config)#ip dhcp snooping action maxnum 100

19.2.2.10 ip dhcp snooping information enable

Command：**ip dhcp snooping information enable**

no ip dhcp snooping information enable

Function：Enable DHCP SNOOPING OPTION 82 function. No command close DHCP Snooping Option82 function.

Parameters：None

Default：DHCP Snooping default close Option 82 function.

Command mode：Globe Mode.

Usage Guide：Only set this command DHCP SNOOPING, the standard option 82 can be added and forwarded by DHCP packet. Option 82 sub-option 1 (circuit ID option) is standard vlan name add physical port, such as 'Vlan1+Ethernet0/0/12'. Option 82 sub-option 2 (remote ID option) is switch CPU MAC, such as '00030f023301'. If getting DHCP request packet with option 82, DHCP Snooping will use self option 82 to replace the option 82 in request packet. If getting DHCP reply packet with option 82, DHCP Snooping will drop the option 82 and then forward DHCP packet.

Example：Enable DHCP SNOOPING option 82 function.

Switch(Config)#ip dhcp snooping enable

Switch(Config)# ip dhcp snooping binding enable

Switch(Config)# ip dhcp snooping information enable

19.2.2.11 ip user helper-address

Command： **ip user helper-address <*svr_addr*> [port <*udp_port*>] source <*src_addr*> [secondary]**

no ip user helper-address [secondary]

Function： Set the address and port of HELPER SERVER

Parameters：

<*svr_addr*>：the IP address of HELPER SERVER 的IP in dotted-decimal notation.

udp_port：the UDP port of HELPER SERVER, the range of which is1－65535, and its default value is 9119.

src_addr：the local management IP address of the switch, in dotted-decimal notation

sencondary：whether it is a secondary SERVER address.

Command mode：Globe Mode.

Default：There is no HELPER SERVER address by default.

Usage Guide：DHCP SNOOPING will send the monitored binding information to HELPER SERVER to save it. If the switch starts abnormally, it can recover the binding data from HELPER SERVER. The HELPER SERVER function usually is integrated into DCBI package. The DHCP SNOOPING and HELPER SERVER use the UDP protocol to communicate, and guarantee the arrival of retransmitted data. **HELPER SERVER configuration can also be used to sent DOT1X user data from the server, the detail of usage is described in the chapter of 'dot1x configuration'.**

Two HELPER SERVER addresses are allowed, DHCP SNOOPING will try to connect to PRIMARY SERVER in the first place. Only when the PRIMARY SERVER is unreachable, will the switch c HELPER SERVER connects to SECONDARY SERVER.

Please pay attention：source address is the effective management IP address of the switch, if the management IP address of the switch changes, this configuration should be updated in time.

Example ： Set the local management IP address as 100.1.1.1, primary HELPER SERVER address as 100.1.1.100 and the port as default value.

```
Switch(Config)#interface vlan 1
Switch(Config- If-Vlan1)#ip address 100.1.1.1 255.255.255.0
Switch(Config-If-Vlan1)exit
Switch(Config)#ip user helper-address 100.1.1.100 source 100.1.1.1
```

19.2.3 DHCP Snooping Typical Applications

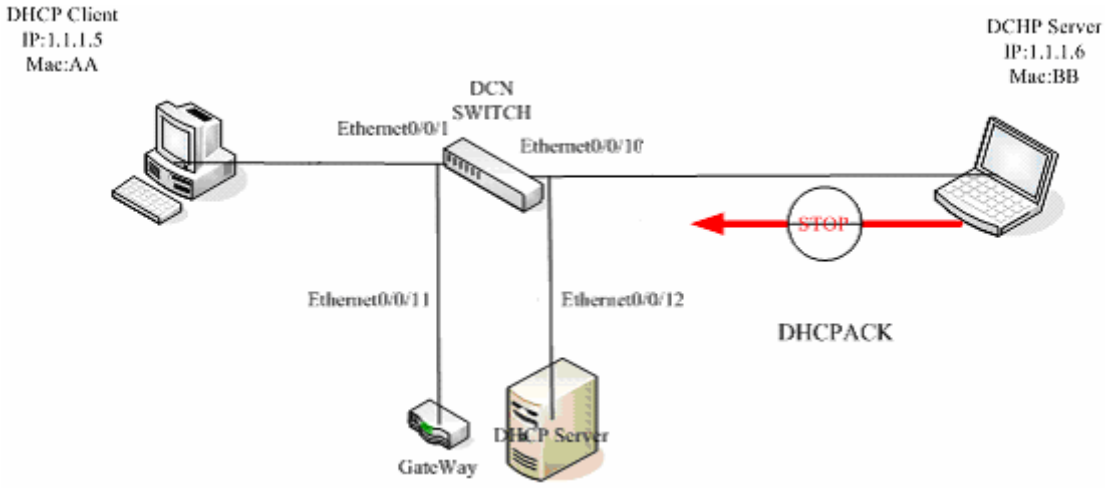


Fig19-1 DHCP Snooping Typical Applications

As showed in the above picture, Mac-AA device is the normal user，connected to the

un-trusted port 0/0/1 of the DCN switch. It acts as DHCP Client, and its IP is 1.1.1.5;DHCP Server and GateWay connect to the trusted ports 0/0/11 and 0/0/12 of the DCN switch; malicious user Mac-BB connects to the un-trusted port 0/0/10, trying to fake a DHCP Server（by sending DHCPACK）. Configuring DHCP Snooping on the switch will effectively discover and block such network attacks.
The followings are the configuration sequence
switch#
switch#config
switch(Config)#ip dhcp snooping
switch(Config)#interface ethernet 0/0/11
switch(Config-Ethernet0/0/11)#ip dhcp snooping trust
switch(Config-Ethernet0/0/11)#exit
switch(Config)#interface ethernet 0/0/12
switch(Config-Ethernet0/0/12)#ip dhcp snooping trust
switch(Config-Ethernet0/0/12)#exit
switch(Config)#interface ethernet 0/0/1-10
switch(Config-Port-Range)#ip dhcp snooping action shutdown
switch(Config-Port-Range)#

19.3 DHCP Snooping Troubleshooting

19.3.1 Monitor and Debug Command List

19.3.1.1 show ip dhcp snooping

Command：show ip dhcp snooping [interface [ethernet] <interfaceName>]
Function： Display the configuration information of the current dhcp snooping or display the defense action log of the specified port.
Parameters: <interfaceName>：The name of the specified port
Command mode：Admin Mode
Default：None
Usage Guide： If there is no specific port, then display the current configuration information of dhcp snooping, otherwise, display the records of defense actions of the specific port.
Example：Switch#show ip dhcp snooping
DHCP Snooping is enabled

DHCP Snooping binding arp: disabled
DHCP Snooping maxnum of action info:10
DHCP Snooping limit rate: 100(pps), switch ID: 0003.0F12.3456
DHCP Snooping droped packets: 0, discarded packets: 0
DHCP Snooping alarm count: 0, binding count: 0,

expired binding: 0, request binding: 0

interface	trust	action	recovery	alarm num	bind num
Ethernet0/0/1	trust	none	0second	0	0
Ethernet0/0/2	untrust	none	0second	0	0
Ethernet0/0/3	untrust	none	0second	0	0
Ethernet0/0/4	untrust	none	0second	0	1
Ethernet0/0/5	untrust	none	0second	2	0
Ethernet0/06	untrust	none	0second	0	0
Ethernet0/07	untrust	none	0second	0	0
Ethernet0/08	untrust	none	0second	0	1
Ethernet0/09	untrust	none	0second	0	0
Ethernet0/010	untrust	none	0second	0	0
Ethernet0/011	untrust	none	0second	0	0
Ethernet0/012	untrust	none	0second	0	0
Ethernet0/013	untrust	none	0second	0	0
Ethernet0/014	untrust	none	0second	0	0
Ethernet0/015	untrust	none	0second	0	0
Ethernet0/016	untrust	none	0second	0	0
Ethernet0/017	untrust	none	0second	0	0
Ethernet0/018	untrust	none	0second	0	0
Ethernet0/019	untrust	none	0second	0	0
Ethernet0/020	untrust	none	0second	0	0
Ethernet0/021	untrust	none	0second	0	0
Ethernet0/022	untrust	none	0second	0	0
Ethernet0/023	untrust	none	0second	0	0
Ethernet0/024	untrust	none	0second	0	0

Displayed information	Explanation
DHCP Snooping is enable	DHCP Snooping is globally enabled or disabled
DHCP Snooping binding arp	Whether the ARP binding function is enabled
DHCP Snooping maxnum of action info	The number limitation of port defense actions
DHCP Snooping limit rate	The rate limitation of receiving packets
switch ID	The switch ID is used to identify the switch, usually using the CPU MAC address.
DHCP Snooping droped packets	The number of dropped messages when the received DHCP messages exceeds the rate limit.
discarded packets	The number of discarded packets caused by the communication failure within the system. If the CPU of the switch is too busy to schedule the DHCP SNOOPING task and thus can not handle the received DHCP messages, such situation might happen.

DHCP Snooping alarm count:	The number of alarm information.
interface	Name of the port
trust	Trust attributes of the port
action	Automatic defense action of the port
recovery	The recovery interval of the automatic defense action of the port
alarm num	The history log number of the automatic defense action of the port
bind num	The number of port specific binding information.

Switch#show ip dhcp snooping interface Ethernet0/0/1
interface Ethernet0/0/1 user config:
trust attribute: untrust
action: none
binding dot1x: disabled
binding user: disabled
recovery interval:0(s)
Alarm info: 0

Binding info: 0

Expired Binding: 0

Request Binding: 0

Displayed information	Explanation
interface	Name of the port
trust attribute	Trust attributes of the port
action	Automatic defense action of the port
recovery interval	The recovery interval of the automatic defense action of the port
maxnum of alarm info	The max number of the automatic defense action that can be recorded of the port
binding dot1x	Whether the binding dot1x function is enabled on the port
binding user	Whether the binding user function is enabled on the port.
Alarm info	The number of alarm information.
Binding info	The number of binding information.
Expired Binding	The expired binding information

19.3.1.2 logging source

Command: logging source {default| m_shell|sys_event|anti_attack} channel { console | logbuff | loghost | monitor } [level { critical | debugging | notifications | warnings } [state { on | off }]]

Function： The details about this command are covered in the chapter on system log; the data source of this command anti_attack records information about all kinds of denfense to network attacks, including the automatic defense action log of dhcp snooping.

Parameters：Please refer to System Logs chapter for detail.

Command mode：Global configuration mode

Default：Not covered

Usage Guide: Please refer to System Logs chapter for detail.

Example: Enable logging of network attacking in the system log buffer.

Switch(Config)#logging source anti_attack channel logbuff

19.3.1.3 show logging last FailureInfo

Command：**show logging lastFailureInfo**

Function：This command is used to display the system abnormal information recorded in the flash. The defense action of DHCP Snooping is also recorded in the flash as system abnormal information, and can be checked via this command.

Command mode：Admin Mode

Example: Display log information.

Switch# show logging lastFailureInfo

19.3.2 DHCP SnoopingTroubleshooting

If there are problems when using DHCP Snooping, please check the following possible reasons:

- ✧ Check whether the global DHCP Snooping switch is enabled;
- ✧ If the port does not response to invalid DHCP Server packets, please check whether the port has been set as an un-trusted port of dhcp snooping.

19.3.2.1 debug ip dhcp snooping packet

Command：**debug ip dhcp snooping packet**

no debug ip dhcp snooping packet

Function：This command is used to enable the DHCP SNOOPING debug switch to debug the procedure of message processing.

Command mode：Admin Mode

Usage Guide: the information that DHCP SNOOPING is receiving messages from a specific port.

19.3.2.2 debug ip dhcp snooping event

Command：debug ip dhcp snooping event
no debug ip dhcp snooping event
Function：This command is used to enable the DHCP SNOOPING debug switch to debug the state of DHCP SNOOPING tasks.
Command mode：Admin Mode
Usage Guide: This command enables displaying debugging information of DHCP packets for DHCP snooping.

19.3.2.3 debug ip dhcp snooping update

Command: debug ip dhcp snooping update
no debug ip dhcp snooping update
Function: This command is used to enable debugging information for DHCP snooping. Debugging information of messages between DHCP snooping and help server will be displayed.
Command mode: Admin Mode.
Usage Guide: This command enables debugging of messages transmitted between DHCP snooping and helper server.

19.3.2.4 debug ip dhcp snooping binding

Command: debug ip dhcp snooping binding
no debug ip dhcp snooping binding
Function: None
Command mode: Admin Mode.
Usage Guide: This command is used to enable debugging information for arp binding, dot1x binding, and user binding for DHCP snooping.

Chapter 20 ARP Guard Configuration

20.1 ARP Guard introduction

There is serious security vulnerability in the design of ARP protocol, which is any network device, can send ARP messages to advertise the mapping relationship between IP address and MAC address. This provides a chance for ARP cheating. Attackers can send ARP REQUEST messages or ARP REPLY messages to advertise a wrong mapping relationship between IP address and MAC address, causing problems in network communication. The danger of ARP cheating has two forms: 1. PC4 sends an ARP message to advertise that the IP address of PC2 is mapped to the MAC address of PC4, which will cause all the IP messages to PC2 will be sent to PC4, thus PC4 will be able to monitor and capture the messages to PC2; 2. PC4 sends ARP messages to advertise that the IP address of PC2 is mapped to an illegal MAC address, which will prevent PC2 from receiving the messages to it. Particularly, if the attacker pretends to be the gateway and do ARP cheating, the whole network will be collapsed.

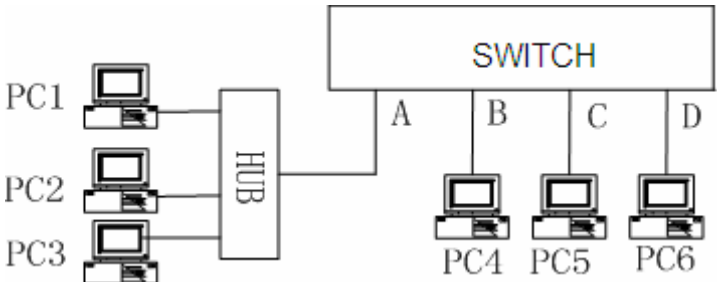


Fig 20-1 ARP GUARD

We utilize the filtering entries of the switch to protect the ARP entries of important network devices from being imitated by other devices. The basic theory of doing this is that utilizing the filtering entries of the switch to check all the ARP messages entering through the port, if the source address of the ARP message is protected, the messages will be directly dropped and will not be forwarded. ARP GUARD function is usually used to protect the gateway from being attacked. If all the accessed PCs in the network should be protected from ARP cheating, then a large number of ARP GUARD address should be configured on the port, which will take up a big part of FFP entries in the chip, and as a result, might affect other applications. So this will be improper. It is recommended that adopting FREE RESOURCE related accessing scheme. Please refer to relative documents for details.

20.2 ARP Guard Configuration

20.2.1 ARP GuardConfiguration Task List

1) **Configure the protected IP address**

Command	Notes
Port Mode	
arp-guard ip <*addr*> **no arp-guard ip <*addr*>**	Configure/Remove the ARP Guard address.

20.2.2 ARP Guard Command List

20.2.2.1 arp-guard ip

Command：**arp-guard ip <addr>**
no arp-guard ip <addr>
Function：Add a ARP GUARD address.
Parameters：**<addr>** is the protected IP address, in dotted decimal notation.
Command mode：Port configuration mode.
Default：There is no ARP GUARD address by default.
Usage Guide：After configuring the ARP GUARD address, the ARP messages received from the ports configured ARP GUARD will be filtered. If the source IP addresses of the ARP messagse match the ARP GUARD address configured on this port, these messages will be judged as ARP cheating messages, which will be directly dropped instead of sending to the CPU of the switch or forwarding. 16 ARP GUARD addresses can be configured on each port.
Example：Configure the ARP GUARD address on port Ethernet0/0/1 as 100.1.1.1.
Switch(Config)#interface ethernet0/0/1
Switch(Config- Ethernet 0/0/1)# arp-guard ip 100.1.1.1

Chapter 21 ARP Scanning Prevention

21.1 Introduction

ARP scanning is a common method of network attack. In order to detect all the active hosts in a network segment, the attack source will broadcast lots of ARP messages in the segment, which will take up a large part of the bandwidth of the network. It might even do large-traffic-attack in the network via fake ARP messages to collapse of the network by exhausting the bandwidth. Usually ARP scanning is just a preface of other more dangerous attack methods, such as automatic virus infection or the ensuing port scanning, ulnerability scanning aiming at stealing information, distorted message attack, and DOS attack, etc.

Since ARP scanning threatens the security and stability of the network with great danger, so it is very significant to prevent it. ES4700BD series switch provides a complete resolution to prevent ARP scanning: if there is any host or port with ARP scanning eatures is found in the segment, the switch will cut off the attack source to ensure the security of the network.

There are two methods to prevent ARP scanning: port-based and IP-based. The port-based ARP scanning will count the number to ARP messages received from a port in a certain time range, if the number is larger than a preset threshold, this port will be ‘down’. The IP-based ARP scanning will count the number to ARP messages received from an IP in the segment in a certain time range, if the number is larger than a preset threshold, any traffic from this IP will be blocked, while the port related with this IP will not be ‘down’. These two methods can be enabled simultaneously. After a port or an IP is disabled, users can recover its state via automatic recovery function.

To improve the effect of the switch, users can configure trusted ports and IP, the ARP messages from which will not be checked by the switch. Thus the load of the switch can be effectively decreased.

21.2 Scanning Prevention Configuration

21.2.1 Scanning Prevention Configuration Task List

1. Enable the ARP Scanning Prevention function.
2. Configure the threshold of the port-based and IP-based ARP Scanning Prevention
3. Configure trusted ports
4. Configure trusted IP
5. Configure automatic recovery time
6. Display relative information of debug information and ARP scanning

1) Enable the ARP Scanning Prevention function.

Command	Notes
Global Mode	
anti-arpscan enable **no anti-arpscan enable**	Enable or disable the ARP Scanning Prevention function globally

2) Configure the threshold of the port-based and IP-based ARP Scanning Prevention

Command	Notes
Global Mode	
anti-arpscan port-based threshold <*threshold-value*> **no anti-arpscan port-based threshold**	Set the threshold of the port-based ARP Scanning Prevention
anti-arpscan ip-based threshold <*threshold-value*> **no anti-arpscan ip-based threshold**	Disable the setting of the threshold of the port-based ARP Scanning Prevention

3) Configure trusted ports

Command	Notes
Port Mode	
anti-arpscan trust <*port*|*supertrust-port*> **no anti-arpscan trust <*port*|*supertrust-port*>**	Set the trust attributes of the ports

4) Configure trusted IP

Command	Notes
Global Mode	
anti-arpscan trust ip <*ip-address*> [<*netmask*>] **no anti-arpscan trust ip <*ip-address*> [<*netmask*>]**	Set attributes of trusted IP.

5) Configure automatic recovery time

Command	Notes
Global Mode	
anti-arpscan recovery enable **no anti-arpscan recovery enable**	Enable or disable the automatic recovery function
anti-arpscan recovery time <*seconds*> **no anti-arpscan recovery time**	Set automatic recovery time

6) Display relative information of debug information and ARP scanning

Command	Notes

Global Mode	
anti-arpscan log enable **no anti-arpscan log enable**	Enable or disable the log function of ARP scanning prevention
anti-arpscan trap enable **no anti-arpscan trap enable**	Enable or disable the SNMP Trap function of ARP scanning prevention
show anti-arpscan [trust <*ip*|*port*|*supertrust-port*> | prohibited <*ip*|*port*>]	Display the state of operation and configuration of ARP scanning prevention
debug anti-arpscan <*port*|*ip*> **no debug anti-arpscan <*port*|*ip*>**	Enable or disable the debug switch of ARP scanning prevention

21.2.2 ARP Scanning Prevention Command List

21.2.2.1 anti-arpscan enable

Command：**anti-arpscan enable**
no anti-arpscan enable

Function：Globally enable ARP scanning prevention function; 'no anti-arpscan enable' command globally disables ARP scanning prevention function.

Parameters：None.

Default：Disable ARP scanning prevention function.

Command mode：Global Mode

User Guide：None

Example：Enable the ARP scanning prevention function of the switch

Switch(Config)#anti-arpscan enable

21.2.2.2 anti-arpscan port-based threshold <*threshold-value*>

Command：**anti-arpscan port-based threshold <*threshold-value*>**
no anti-arpscan port-based threshold

Function：Set the threshold of received messages of the port-based ARP scanning prevention. If the rate of received ARP messages exceeds the threshold, the port will be closed. The unit is packet/second. The 'no anti-arpscan port-based threshold' command will reset the default value, 5 packets per second.

Parameters：rate threshold, ranging from 2 to 200.

Default：5 packets per second

Command mode：Global Mode

User Guide：The threshold of port-based ARP scanning prevention should be larger than the threshold of IP-based ARP scanning prevention, or, the IP-based ARP scanning prevention will fail.

Example ： Set the threshold of port-based ARP scanning prevention as10 packets/second.

Switch(Config)#anti-arpscan port-based threshold 20

21.2.2.3 anti-arpscan ip-based threshold *<threshold-value>*

Command：**anti-arpscan ip-based threshold *<threshold-value>***
no anti-arpscan ip-based threshold

Function：Set the threshold of received messages of the IP-based ARP scanning prevention. If the rate of received ARP messages exceeds the threshold, the IP messages from this IP will be blocked. The unit is packet/second. The 'no anti-arpscan ip-based threshold' command will reset the default value, 3 packets per second.

Parameters：rate threshold, ranging from 2 to 200.

Default：3 packets per second

Command mode：Global Mode

User Guide：the threshold of port-based ARP scanning prevention should be larger than the threshold of IP-based ARP scanning prevention, or, the IP-based ARP scanning prevention will fail.

Example：Set the threshold of IP-based ARP scanning prevention as 6 packets per second.

Switch(Config)#anti-arpscan port-based threshold 6

21.2.2.4 anti-arpscan trust *<port|supertrust-port>*

Command：**anti-arpscan trust <port | supertrust-port>**
no anti-arpscan trust <port | supertrust-port>

Function：Configure a port as a trusted port or a super trusted port;' no anti-arpscan trust <port | supertrust-port>'command will reset the port as an untrusted port.

Parameters：None.

Default：By default all the ports are non- trustful.

Command mode：Port Mode.

User Guide：If a port is configured as a trusted port, then the ARP scanning prevention function will not deal with this port, even if the rate of received ARP messages exceeds the set threshold, this port will not be closed, but the non- trustful IP of this port will still be checked. If a port is set as a super non- trustful port, then neither the port nor the IP of the port will be dealt with. If the port is already closed by ARP scanning prevention, it will be opened right after being set as a trusted port.

Example：Set port ethernet 1/5 of the switch as a trusted port

Switch(Config)#interface ethernet 0/0/5

Switch(Config-if-ethernet 0/0/5)# anti-arpscan trust port

21.2.2.5 anti-arpscan trust ip *<ip-address>* [*<netmask>*]

Command：**anti-arpscan trust ip <ip-address [<netmask>]>**
no anti-arpscan trust ip <ip-address [<netmask>]>

Function ： Configure trusted IP;' no anti-arpscan trust ip <ip-address[<netmask>]>'command reset the IP to non-trustful IP.

Parameters：Net mask of the IP

Default：By default all the IP are non-trustful. Default mask is 255.255.255.255

Command mode：Global Mode

User Guide：If a port is configured as a trusted port, then the ARP scanning prevention function will not deal with this port, even if the rate of received ARP messages exceeds the set threshold, this port will not be closed. If the port is already closed by ARP scanning prevention, its traffic will be recovered right immediately.

Example：Set 192.168.1. 0/24 as trusted IP

Switch(Config)#anti-arpscan trust ip 192.168.1.100 255.255.255.0

21.2.2.6 anti-arpscan recovery enable

Command：**anti-arpscan recovery enable**

no anti-arpscan recovery enable

Function：Enable the automatic recovery function, 'no anti-arpscan recovery enable' command will disable the function.

Parameters：None

Default：Enable the automatic recovery function

Command mode：Global Mode

User Guide：If the users want the normal state to be recovered after a while the port is closed or the IP is disabled, they can configure this function.

Example：Enable the automatic recovery function of the switch.

Switch(Config)#anti-arpscan recovery enable

21.2.2.7 anti-arpscan recovery time <*seconds*>

Command：**anti-arpscan recovery time <*seconds*>**

no anti-arpscan recovery time

Function：Configure automatic recovery time; 'no anti-arpscan recovery time' command resets the automatic recovery time to default value.

Parameters：automatic recovery time, in second ranging from 5 to 86400

Default：300 seconds

Command mode：Global Mode

User Guide: Automatic recovery function should be enabled first.

Example：Set the automatic recovery time as 3600 seconds

Switch(Config)#anti-arpscan recovery time 3600

21.2.2.8 anti-arpscan log enable

Command：**anti-arpscan log enable**

no anti-arpscan log enable

Function：Enable ARP scanning prevention log function;' no anti-arpscan log enable' command will disable this function.

Parameters：None.

Default：Enable ARP scanning prevention log function

Command mode：Global Mode

User Guide: After enabling ARP scanning prevention log function, users can check the detailed information of ports being closed or automatically recovered by ARP scanning prevention or IP being disabled and recovered by ARP scanning prevention. The level of the log is 'Warning'.

Example：Enable ARP scanning prevention log function of the switch

Switch(Config)#anti-arpscan log enable

21.2.2.9 anti-arpscan trap enable

Command：**anti-arpscan trap enable**

no anti-arpscan trap enable

Function：Enable ARP scanning prevention SNMP Trap function;' no anti-arpscan trap enable' command disable ARP scanning prevention SNMP Trap function.

Parameters：None.

Default：Disable ARP scanning prevention SNMP Trap function

Command mode：Global Mode

User Guide: After enabling ARP scanning prevention SNMP Trap function, users will receive Trap message whenever a port is closed or recovered by ARP scanning prevention, and whenever IP t is closed or recovered by ARP scanning prevention

Example：Enable ARP scanning prevention SNMP Trap function of the switch

Switch(Config)#anti-arpscan trap enable

21.3 ARP Scanning Prevention Troubleshooting

ARP scanning prevention is disabled by default. After enabling ARP scanning prevention, users can enable the debug switch, 'debug anti-arpscan', to view debug information.

If the state of a port is showed as not closed when using 'show anti-arpscan', It means that the port is not closed by the ARP scanning prevention function. If the port is closed by other modules, users can check it with 'show interface'.

The max number of IP that can be disabled by IP-based ARP scanning prevention is 128. If the limit is exceeded, users will see a prompt.

21.3.1 ARP Scanning Prevention Debug Command List

21.3.1.1 show anti-arpscan [trust <ip|port|supertrust-port> | prohibited <ip|port>]

Command：**show anti-arpscan [trust <ip | port | supertrust-port> |prohibited <ip | port>]**

Function：Display the operation information of ARP scanning prevention function

Parameters：None.

Default: Display every port to tell whether it is a trusted port and whether it is closed. If the port is closed, then display how long it has been closed. Display all the trusted IP and disabled IP.

Command mode：Admin Mode

User Guide：Use 'show anti-arpscan trust port' if users only want to check trusted ports. The reset follow the same rule.

Example：Check the operating state of ARP scanning prevention function after enabling it.

```
Switch(Config)#show anti-arpscan
Total port: 36
Name              Port-property   beShut   shutTime(seconds)
Ethernet0/0/1       untrust         N        0
Ethernet0/0/2       untrust         N        0
Ethernet0/0/3       untrust         N        0
Ethernet0/0/4       untrust         Y        132
Ethernet0/0/5       untrust         N        0
Ethernet0/0/6       untrust         N        0
Ethernet0/0/7       untrust         N        0
Ethernet0/0/8       untrust         N        0
Ethernet0/0/9       untrust         N        0
Ethernet0/0/10      untrust         N        0
Ethernet0/0/11        trust         N        0
Ethernet0/0/12      untrust         N        0
Ethernet0/0/13      untrust         N        0
Ethernet0/0/14      untrust         N        0
Ethernet0/0/15      untrust         N        0
Ethernet0/0/16      untrust         N        0
Ethernet0/0/17      untrust         N        0
Ethernet0/0/18      untrust         N        0
Ethernet0/0/19      untrust         N        0
Ethernet0/0/20      untrust         N        0
Ethernet0/0/21      untrust         N        0
Ethernet0/0/22      untrust         N        0
Ethernet0/0/23      untrust         N        0
Ethernet0/0/24      untrust         N        0

Prohibited IP:
IP                  shutTime(seconds)
1.1.1.2             132

Trust IP:
192.168.99.5        255.255.255.255
192.168.99.6        255.255.255.255
```

192.168.99.7 255.255.0.0

21.3.1.2 debug anti-arpscan [port|ip]

Command：debug anti-arpscan <port | ip>
no debug anti-arpscan <port | ip>
Function：Enable the debug switch of ARP scanning prevention;' no debug anti-arpscan <port | ip>' command disables the switch.
Parameters：None.
Default: Disable the debug switch of ARP scanning prevention
Command mode：Admin Mode
User Guide：After enabling debug switch of ARP scanning prevention users can check corresponding debug information or enable the port-based or IP-based debug switch separately whenever a port is closed by ARP scanning prevention or recovered automatically, and whenever IP t is closed or recovered .
Example：Enable the debug function for ARP scanning prevention of the switch.
Switch(Config)#debug anti-arpscan

21.4 ARP Scanning Prevention Typical Example

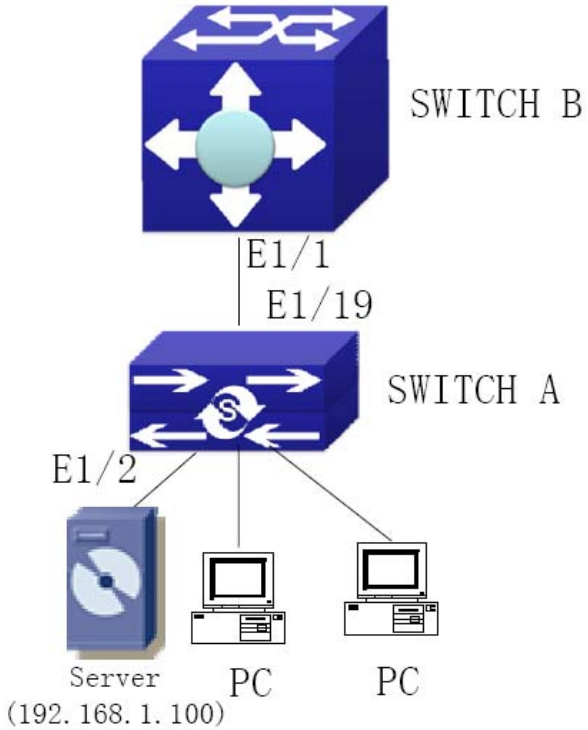


Fig 21-1 ARP scanning prevention typical configuration example

In the network topology above, port E0/0/1 of SWITCH B is connected to port E0/0/19 of SWITCH A, the port E0/0/2 of SWITCH A is connected to file server (IP address is

192.168.1.100), and all the other ports of SWITCH A are connected to common PC. The following configuration can prevent ARP scanning effectively without affecting the normal operation of the system.

SWITCH A configuration task sequence:

```
SwitchA(config)#anti-arpscan enable
SwitchA(config)#anti-arpscan recovery time 3600
SwitchA(config)#anti-arpscan trust ip 192.168.1.100 255.255.255.0
SwitchA(config)#interface ethernet 0/0/2
SwitchA (Config-If-Ethernet0/0/2)#anti-arpscan trust port
SwitchA (Config-If-Ethernet0/0/2)#exit
SwitchA(config)#interface ethernet 0/0/19
SwitchA (Config-If-Ethernet0/0/19)#anti-arpscan trust supertrust-port
Switch A(Config-If-Ethernet0/0/19)#exit
```

SWITCHB configuration task sequence:

```
Switch B(Config)#anti-arpscan enable
SwitchB(config)#interface ethernet 0/0/1
SwitchB (Config-If-Ethernet0/0/1)#anti-arpscan trust port
SwitchB (Config-If-Ethernet0/0/1)exit
```

Chapter 22 Port Loopback Detection

22.1 Introduction to Port Loopback Detection

With the development of switches, more and more users begin to access the network through Ethernet switches. In enterprise network, users access the network through layer-2 switches, which means urgent demands for both internet and the internal layer 2 Interworking. When layer 2 Interworking is required, the messages will be forwarded through MAC addressing the accuracy of which is the key to a correct Interworking between users. In layer 2 switching, the messages are forwarded through MAC addressing. Layer 2 devices learn MAC addresses via learning source MAC address, that is, when the port receives a message from an unknown source MAC address, it will add this MAC to the receive port, so that the following messages with a destination of this MAC can be forwarded directly, which also means learn the MAC address once and for all to forward messages.

When a new source MAC is already learnt by the layer 2 device, only with a different source port, the original source port will be modified to the new one, which means to correspond the original MAC address with the new port. As a result, if there is any loopback existing in the link, all MAC addresses within the whole layer 2 network will be corresponded with the port where the loopback appears (usually the MAC address will be frequently shifted from one port to another), causing the layer 2 network collapsed. That is why it is a necessity to check port loopbacks in the network. When a loopback is detected, the detecting device should send alarms to the network management system, ensuring the network manager is able to discover, locate and solve the problem in the network and protect users from a long-lasting disconnected network.

Since detecting loopbacks can make dynamic judgment of the existence of loopbacks in the link and tell whether it has gone, the devices supporting port control (such as port isolation and port MAC address learning control) can maintain that automatically, which will not only reduce the burden of network managers but also response time, minimizing the effect caused loopbacks to the network.

22.2 Port Loopback Detection Configuration

22.2.1 Port Loopback Detection Configuration Task List

1. Configure the time interval of loopback detection
2. Enable the function of port loopback detection
3. Configure the control method of port loopback detection

4．Display and debug the relevant information of port loopback detection

1) **Configure the time interval of loopback detection**

Commands	Notes
Global Mode	
loopback-detection interval-time <*loopback*> <*no-loopback*>	Configure the time interval of loopback detection

2) **Enable the function of port loopback detection**

Commands	Notes
Port Mode	
loopback-detection specified-vlan <*vlan-list*> **no loopback-detection specified-vlan <*vlan-list*>**	Enable and disable the function of port loopback detection

3) **Configure the control method of port loopback detection**

Commands	Notes
Port Mode	
loopback-detection control {*shutdown*|*block*|*learning*|*trap*} **no loopback-detection control**	Enable and disable the function of port loopback detection control

4) **Display and debug the relevant information of port loopback detection**

Commands	Notes
Admin Mode	
debug loopback-detection **no debug loopback-detection**	Enable the debug information of the function module of port loopback detection. The no operation of this command will disable the debug information.
show loopback-detection [interface <*interface-list*>]	Display the state and result of the loopback detection of all ports, if no parameter is provided; otherwise, display the state and result of the corresponding ports.

22.2.2 Port Loopback Detection Command List

22.2.2.1 loopback-detection control

Command：loopback-detection control {shutdown |block| learning | trap}

no loopback-detection control

Function：Enable the function of loopback detection control on a port, the no operation of this command will disable the function.

Parameters：**shutdown** set the control method as shutdown, which means to close down the port if a port loopback is found.

block set the control method as block, which means to block a port by allowing bpdu messages only if a port loopback is found.

learning disable the control method of learning MAC addresses on the port, drop received messages and delete the MAC address of the port.

trap Only allow trap messages to be sent from the port.

Default：Disable the function of loopback diction control.

Command mode：Port Mode.

Usage Guide：If there is any loopback, the control operation will be cancelled after a certain period of time after enabling it on the port, usually 2 seconds before sending the next detection message. So, the detection interval should be as long as possible when the function of loopback detection control is enabled on a port to avoid a repeated control operation on the port. If the control method is block, the corresponding relationship between instance and vlan id should be set manually by users.

Example：Enable the function of loopback detection control under ethernet 0/0/2 mode.

Switch(Config)#interface ethernet 0/0/2

Switch(Config-Ethernet0/0/2)#loopback-detection control shutdown

Switch(Config-Ethernet0/0/2)#loopback-detection control

22.2.2.2 loopback-detection specified-vlan

Command：**loopback-detection specified-vlan <*vlan-list*>**

no loopback-detection specified-vlan [<*vlan-list*>]

Function：Enable the function of loopback detection on the port and specify the VLAN to be checked; the no operation of this command will disable the function of detecting loopbacks through this port or the specified VLAN.

Parameters：***<vlan-list>*** the list of VLANs allowed passing through the port. Given the situation of a trunk port, the specified vlans can be checked. So this command is used to set the vlan list to be checked.

Default：Disable the function of detecting the loopbacks through the port.

Command mode：Interface Mode.

Usage Guide：If a port can be a TRUNK port of multiple Vlans, the detection of loopbacks can be implemented on the basis of port+Vlan, which means the objects of the detection can be the specified Vlans on a port. If the port is an ACCESS port, only one Vlan on the port is allowed to be checked despite the fact that multiple Vlans can be configured. This function is not supported under Port-channel.

Example：Enable the function of loopback detection under ethernet 0/0/2 mode.

Switch(Config)#interface ethernet 0/0/2

Switch(Config-Ethernet0/0/2)#switchport mode trunk

Switch(Config-Ethernet0/0/2)#switchport trunk allowed vlan all

Switch(Config-Ethernet0/0/2)#loopback-detection specified-vlan 1;3;5-20

22.2.2.3 loopback-detection interval-time

Command：loopback-detection interval-time *<loopback> <no-loopback>*
Function：Set the loopback detection interval.
Parameters：***<loopback >*** the detection interval if any loopback is found, ranging from 5 to 300, in seconds.
<no-loopback > the detection interval if no loopback is found, ranging from 1 to 30, in seconds.
Default：The default value is 30s with loopbacks existing and 10s otherwise.
Command mode：Global Mode.
Usage Guide：When there is no loopback detection, the detection interval can be relatively shorter, for too short a time would be a disaster for the whole network if there is any loopback. So, a relatively longer interval is recommended when loopbacks exist.
Example：Set the loopback diction interval as 35,15.
Switch(Config)#loopback-detection interval-time 35 15

22.3 Port Loopback Detection Example

Fig 22-1 A Typical Example of Port Loopback Detection

As is shown in the above configuration, the switch will detect the existence of loopbacks in the network topology. After enabling the function of loopback detection on the port connecting the switch with the outside network, the switch will notify the connected network about the existence of a loopback, and control the port on the switch to guarantee the normal operation of the whole network.
The configuration task sequence of SWITCH:
Switch(config)#loopback-detection interval-time 35 15

Switch (config)#interface ethernet 0/0/1
Switch (Config-If-Ethernet0/0/1)#loopback-detection special-vlan 1-3
Switch (Config-If-Ethernet0/0/1)#loopback-detection control block

22.4 Port Loopback Detection Troubleshooting

22.4.1 Port Loopback Debugging Command List

22.4.1.1 show loopback-detection

Command：show loopback-detection [interface <*interface-list*>]
Function：Display the state of loopback detection on all ports if no parameter is provided, or the state and result of the specified ports according to the parameters.
Parameters：**<*interface-list*>** the list of ports to be displayed, supporting punctuations like ';' '-'; for example: ethernet 1/1;2;5 or ethernet 1/1-6;8.
Command mode：Admin Mode.
Usage Guide：Display the state and result of loopback detection on ports with this command.
Example：Display the state of loopback detection on port 4.
Switch(Config)# show loopback-detection interface Ethernet 1/4
loopback detection config and state information in the switch!
Ethernet 1/4
Port loopback detection: No
Port control mode: block
Is port controlled: No!
Switch(Config)#

22.4.1.2 debug loopback-detection

Command：debug loopback-detection
Function：After enabling the loopback detection debug on a port, BEBUG information will be generated when sending, receiving messages and changing states.
Parameters：None.
Command mode：Admin Mode.
Default：Disabled by default..
Usage Guide：Display the message sending, receiving and state changes with this command.
Example：
Switch#debug loopback-detection
%Jan 01 03:29:18 2006 Send loopback detection packet:dev Ethernet0/0/10, vlan id 1
%Jan 01 03:29:18 2006 Send loopback detection packet:dev Ethernet0/0/10, vlan id 2

22.4.2 Port Loopback Dection Troubleshooting

The function of port loopback detection is disabled by default and should only be enabled if required, or it might affect the performance of the system because that the loopback detection messages are broadcast messages.

With normal configuration, after enabling the function of port loopback detection, the ‘debug loopback detection’ command can be used to check the detailed information of loopback detection and the validity of the detection result, if there is an obvious loopback in the connected network.

Chapter 23 SNTP Configuration

23.1 SNTP Introduction

The Network Time Protocol (NTP) is widely used for clock synchronization for global computers connected to the Internet. NTP can assess packet sending/receiving delay in the network, and estimate the computer's clock deviation independently, so as to achieve high accuracy in network computer clocking. In most positions, NTP can provide accuracy from 1 to 50ms according to the characteristics of the synchronization source and network route.

Simple Network Time Protocol (SNTP) is the simplified version of NTP, removing the complex algorithm of NTP. SNTP is used for hosts who do not require full NTP functions, it is a subset of NTP. It is common practice to synchronize the clocks of several hosts in local area network with other NTP hosts through the Internet, and use those hosts to provide time synchronization service for other clients in LAN. The figure below (Fig 23-1) depicts a NTP/SNTP application network topology, where SNTP mainly works between second level servers and various terminals since such scenarios do not require very high time accuracy, and the accuracy of SNTP (1 to 50 ms) is usually sufficient for those services.

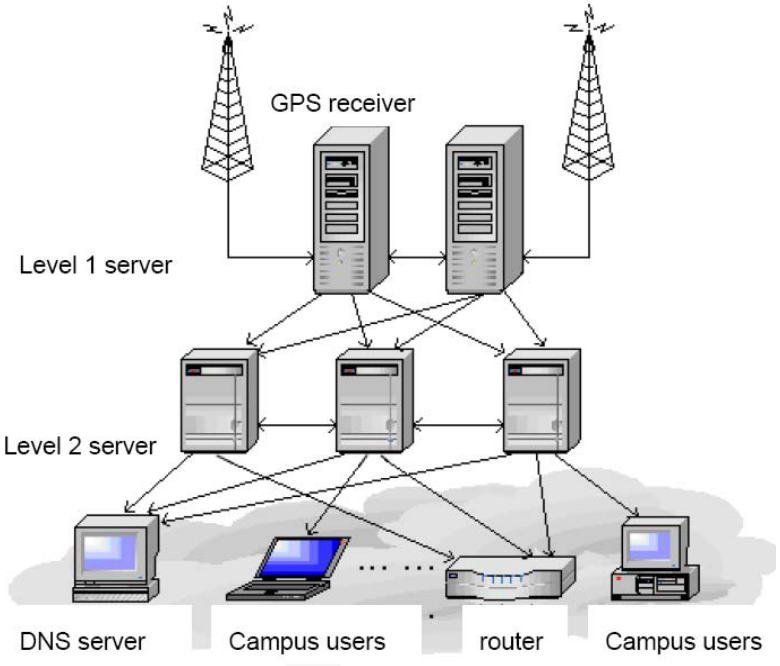


Fig 23-1 NTP/SNTP work environment

DCS-3950 series switch implements SNTPv4 and supports SNTP client unicast as described in RFC2030; SNTP client multicast and unicast are not supported, nor is the

SNTP server function.

23.2 SNTP Configuration

23.2.1 SNTP Configuration Task List

1. Configuration of the time server address.
2. Configuration of the SNTP poll interval..
3. Configuration of the time zone.

1. Configuration of the time server address

Commands	Notes
Global Mode	
sntp server <*server_address*> [version <*version_no*>] **no sntp server <*server_address*>**	To configure or remove SNTP/NTP server address configuration and version.

2. Configuration of the SNTP poll interval

Commands	Notes
Global Mode	
sntp polltime <*interval*> **no sntp polltime**	To configure the interval of polling messages sent by the SNTP client.

3. Configuration of the time zone.

Commands	Notes
Global Mode	
sntp timezone <*name*> *{add|subtract}* **<*time_difference*>** **no sntp timezone**	To configure the time zone for the client and differences with UTC.

23.2.2 SNTP Command List

23.2.2.1 sntp server

Command：sntp server <server_address> [version <version_no>]
no sntp server <server_address>

Function: Configure the addresses and the version of the SNTP/NTP server; the ‘no’ form of this command cancels the configured SNTP/NTP server addresses.

Parameter：*<server_address>* is the IPv4 unicast address of the SNTP/NTP server, ***<version_no>*** is the version No. of the SNTP on current server,ranging between 1-4 and defaulted at 1.
Default: No sntp/ntp configured by default.
Command mode: Global Mode
Example: Configure the address of a SNTP/NTP server.
Switch(Config)#sntp server 10.1.1.1 version 4

23.2.2.2 sntp polltime

Command:sntp polltime <interval>
no sntp polltime
Function: Set the interval for SNTP clients to send requests to NTP/SNTP; the '**no sntp polltime**' command cancels the polltime sets and restores the default setting.Resume default value seconds
Parameters: < *interval*> is the interval value from 16 to 16284
Default: The default polltime is 64 seconds.
Command mode: Global Mode
Example: Set the client to send request to the server every 128 seconds.
Switch#config
Switch(Config)#sntp polltime 128

23.2.2.3 sntp timezone

Command: sntp timezone <name> {add | subtract} <time_difference>
no sntp timezone
Function: Set the time difference between the time zone in which the SNTP client resides and UTC. The '**no sntp timezone**' command cancels the time zone set and restores the default setting.
Parameter: *<name>* is the time zone name, up to 16 characters are allowed; ***<add>*** means the time zone equals UTC time plus ***<time_difference>***; ***<subtract>*** means the time zone equals UTC time minus ***<time_difference>***; ***<time_difference>*** is the time difference, from 1 to 12.
Default: The default time difference setting is 'add 8'.
Command mode: Global Mode
Example: Set the customer timezone to be Beijing (UTC+8)
Switch#config
Switch(Config)#sntp timezone beijing add 8

23.3 SNTP Troubleshooting

23.3.1 SNTP Debugging Command List

23.3.1.1 show sntp

Command：show sntp
Function：Display the current configuration of SNTP client and the server state.
Parameters：None
Command mode：Admin Mode.
Example: Display current SNTP configuration.
Switch#show sntp
server address version last receive
2.1.0.2 1 never

Displayed Information	Explanation
server address	IP address of SNTP server;
version	The version of SNTP protocol;
last receive	The IP address of the last received SNTP server.

23.3.1.2 debug sntp

Command: debug sntp {adjust | packet | select }
no debug sntp {adjust | packet | select}
Function: Displays or disables SNTP debug information.
Parameters: adjust stands for SNTP clock adjustment information; **packet** for SNTP packets, **select** for SNTP clock selection.
Command mode: Admin Mode
Example: Display debugging information for SNTP packet.
Switch#debug sntp packet

23.4 Typical SNTP Configuration Example

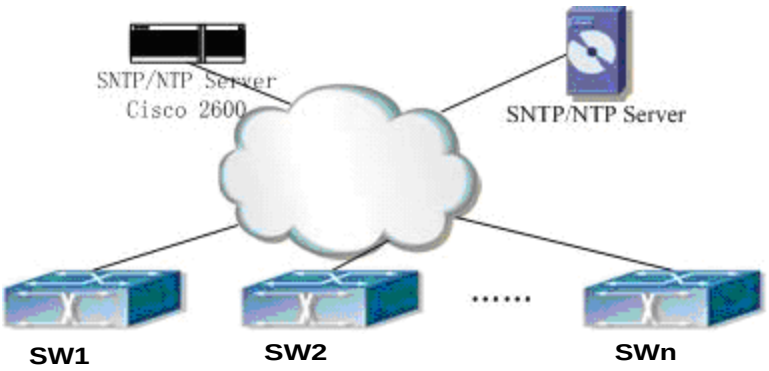


Fig 23-2 Typical SNTP Configuration

All DCS-3950 series switch in the autonomous zone are required to perform time synchronization, which is done through two redundant SNTP/NTP servers. For time to be synchronized, the network must be properly configured. There should be reachable route between any DCS-3950 series switch and the two SNTP/NTP servers.
Example: Assume the IP addresses of the SNTP/NTP servers are 10.1.1.1 and 20.1.1.1, respectively, and SNTP/NTP server function (such as NTP master) is enabled, then configurations for any DCS-3950 series switch should like the following:

Switch #config
Switch (config)#sntp server 10.1.1.1
Switch (config)#sntp server 20.1.1.1
From now on, SNTP would perform time synchronization to the server according to the default setting (polltime 64s, version 1).

Chapter 24 QoS Configuration

24.1 Introduction to QoS

QoS (Quality of Service) is a set of capabilities that allow you to create differentiated services for network traffic, thereby providing better service for selected network traffic. QoS is a guarantee for service quality of consistent and predictable data transfer service to fulfill program requirements. QoS cannot generate extra bandwidth but provides more effective bandwidth management according to the application requirement and network management policy.

24.1.1 QoS Terms

CoS: Class of Service, the classification information carried by Layer 2 802.1Q frames, taking 3 bits of the Tag field in frame header, is called user priority level in the range of 0 to 7.

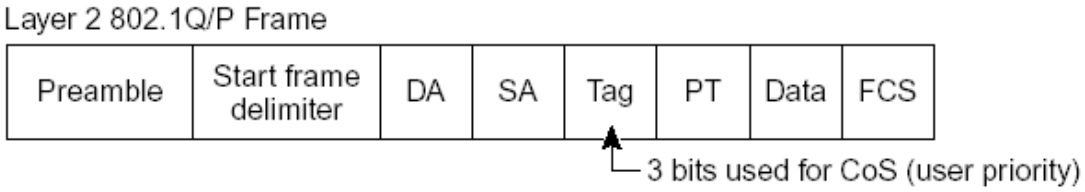


Fig 24-1 CoS priority

ToS: Type of Service, a one-byte field carried in Layer 3 IPv4 packet header to symbolize the service type of IP packets. Among ToS field can be IP Precedence value or DSCP value.

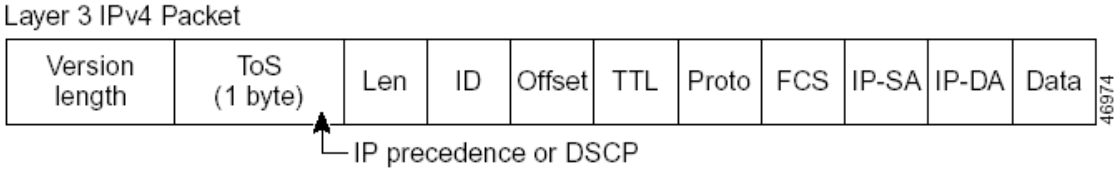


Fig 24-2 ToS priority

IP Precedence： IP priority.Classification information carried in Layer 3 IP packet header, occupying 3 bits, in the range of 0 to 7.

DSCP： Differentiated Services Code Point, classification information carried in Layer 3 IP packet header, occupying 6 bits, in the range of 0 to 63, and is downward compatible with IP Precedence.

Classification: The entry action of QoS, classifying packet traffic according to the classification information carried in the packet and ACLs.
Policing: Ingress action of QoS that lays down the policing policy and manages the classified packets.
Remark: Ingress action of QoS, perform allowing, degrading or discarding operations to packets according to the policing policies.
Queuing: Egress QoS action. Put the packets to appropriate egress queues according to the packet CoS value.
Scheduling: QoS egress action. Configure the weight for eight egress queues WRR (Weighted Round Robin).
In Profile: Traffic within the QoS policing policy range (bandwidth or burst value) is called 'In Profile'.
Out of Profile: Traffic out the QoS policing policy range (bandwidth or burst value) is called 'Out of Profile'.

24.1.2 QoS Implementation

To implement switch software QoS, a general, mature reference model should be given. QoS can not create new bandwidth, but can maximize the adjustment and configuration for the current bandwidth resource. Fully implemented QoS can achieve complete management over the network traffic. The following is as accurate as possible a description of QoS.

The data transfer specifications of IP cover only addresses and services of source and destination, and ensure correct packet transmission using OSI layer 4 or above protocols such as TCP. However, rather than provide a mechanism for providing and protecting packet transmission bandwidth, IP provide bandwidth service by the best effort. This is acceptable for services like Mail and FTP, but for increasing multimedia business data and e-business data transmission, this best effort method cannot satisfy the bandwidth and low-lag requirement.

Based on differentiated service, QoS specifies a priority for each packet at the ingress. The classification information is carried in Layer 3 IP packet header or Layer 2 802.1Q frame header. QoS provides same service to packets of the same priority, while offers different operations for packets of different priority. QoS-enabled switch or router can provide different bandwidth according to the packet classification information, and can remark on the classification information according to the policing policies configured, and may discard some low priority packets in case of bandwidth shortage.

If devices of each hop in a network support differentiated service, an end-to-end QoS solution can be created. QoS configuration is flexible, the complexity or simplicity depends on the network topology and devices and analysis to incoming/outgoing traffic.

24.1.3 Basic QoS Model

The basic QoS consists of five parts: Classification, Policing, Remark, Queuing and

Scheduling, where classification, policing and remark are sequential ingress actions, and Queuing and Scheduling are QoS egress actions.

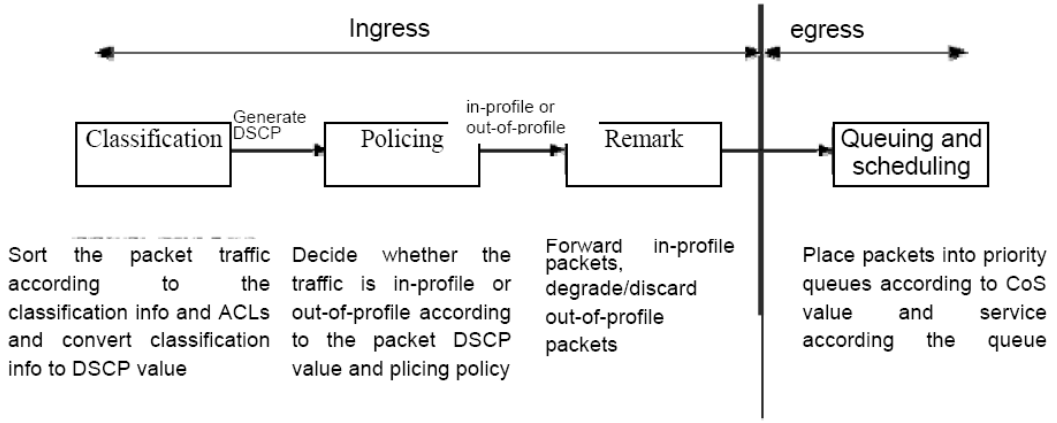

Ingress
egress
Classification
Generate DSCP
Policing
in-profile or out-of-profile
Remark
Queuing and scheduling
Sort the packet traffic according to the classification info and ACLs and convert classification info to DSCP value
Decide whether the traffic is in-profile or out-of-profile according to the packet DSCP value and plicing policy
Forward in-profile packets, degrade/discard out-of-profile packets
Place packets into priority queues according to CoS value and service according the queue

Fig 24-3 Basic QoS Model

Classification: Classify traffic according to packet classification information and generate internal DSCP value based on the classification information. For different packet types and switch configurations, classification is performed differently; the flowchart below explains this in detail

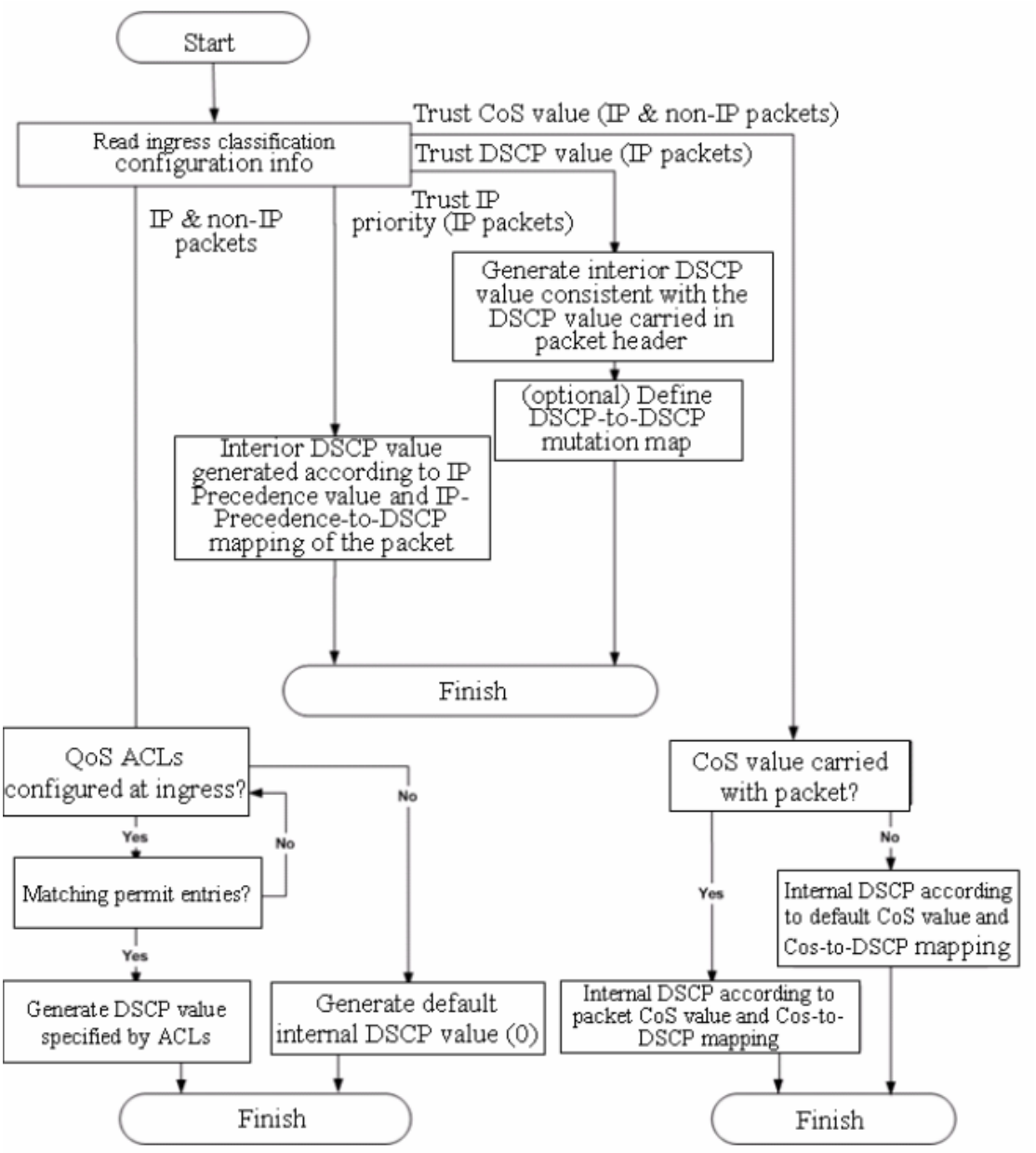

Start
Read ingress classification configuration info
Trust CoS value (IP & non-IP packets)
Trust DSCP value (IP packets)
Trust IP priority (IP packets)
IP & non-IP packets
Generate interior DSCP value consistent with the DSCP value carried in packet header
(optional) Define DSCP-to-DSCP mutation map
Interior DSCP value generated according to IP Precedence value and IP-Precedence-to-DSCP mapping of the packet
Finish
QoS ACLs configured at ingress?
Yes
No
Matching permit entries?
Yes
No
Generate DSCP value specified by ACLs
Generate default internal DSCP value (0)
Finish
CoS value carried with packet?
Yes
No
Internal DSCP according to packet CoS value and Cos-to-DSCP mapping
Internal DSCP according to default CoS value and Cos-to-DSCP mapping
Finish

Fig 24-4 Classification process

Policing and remark: Each packet in classified ingress traffic is assigned an internal DSCP value and can be policed and remarked.

Policing can be performed based on DSCP value to configure different policies that allocate bandwidth to classified traffic. If the traffic exceeds the bandwidth set in the policy (out of profile), the out of profile traffic can be allowed, discarded or remarked. Remarking uses a new DSCP value of lower priority to replace the original higher level DSCP value in the packet; this is also called ‘marking down’. The following flowchart describes the operations during policing and remarking

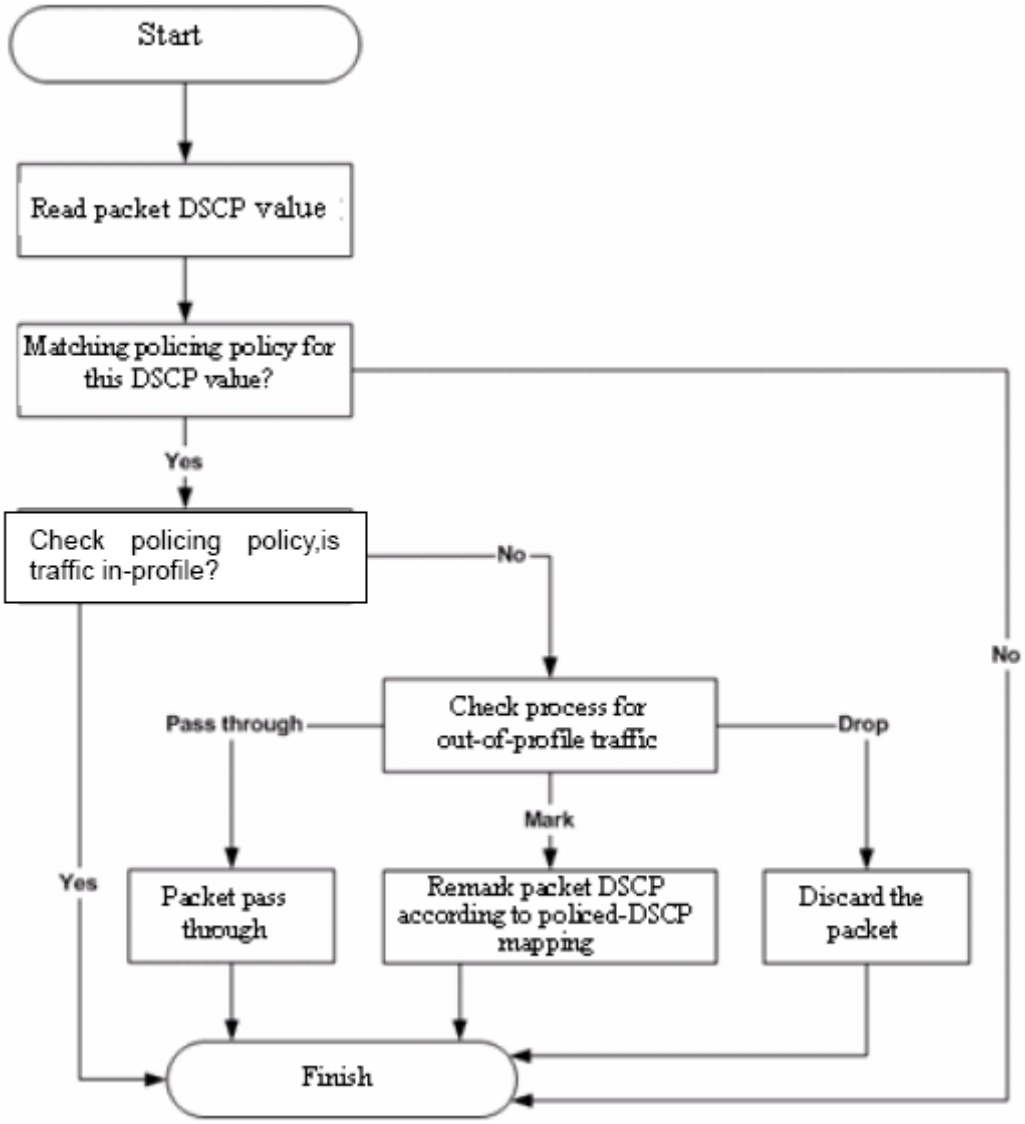


Fig 24-5 Policing and Remarking process

Queuing and scheduling: Packets at the egress will re-map the internal DSCP value to CoS value, the queuing operation assigns packets to appropriate queues of priority according to the CoS value; while the scheduling operation performs packet forwarding according to the prioritized queue weight. The following flowchart describes the operations during queuing and scheduling.

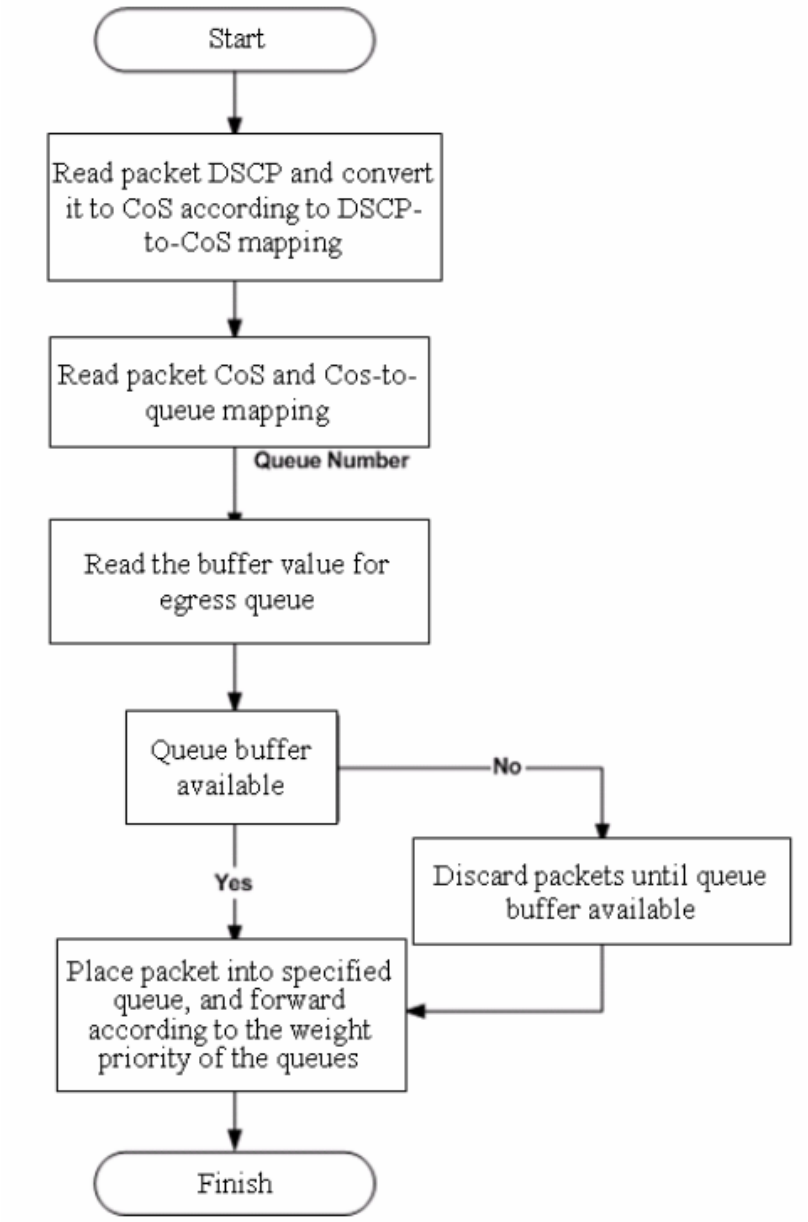

Start
Read packet DSCP and convert it to CoS according to DSCP-to-CoS mapping
Read packet CoS and Cos-to-queue mapping
Queue Number
Read the buffer value for egress queue
Queue buffer available
No
Yes
Discard packets until queue buffer available
Place packet into specified queue, and forward according to the weight priority of the queues
Finish

Fig 24-6 Queuing and Scheduling process

24.2 QoS Configuration

24.2.1 QoS Configuration Task List

1. Enable QoS
   QoS can be enabled or disabled in Global Mode. QoS must be enabled first in Global Mode to configure the other QoS commands.
2. Configure class map.

Set up a classification rule according to ACL, VLAN ID, IP Precedence or DSCP to classify

the data stream. Different classes of data streams will be processed with different policies.

3. Configure a policy map.
   After data steam classification, a policy map can be created to associate with the class map created earlier and enter class mode. Then different policies (such as bandwidth limit, priority degrading, assigning new DSCP value) can be applied to different data streams. You can also define a policy set that can be use in a policy map by several classes.
4. Apply QoS to the ports
   Configure the trust mode for ports or bind policies to ports. A policy will only take effect on a port when it is bound to that port.
5. Configure queue out method and weight
   Configure queue out to PQ or WRR, set the proportion of the 8 egress queues bandwidth and mapping from internal priority to egress queue.
6. Configure QoS mapping
   Configure the mapping from CoS to DSCP, DSCP to CoS, DSCP to DSCP mutation, IP precedence to DSCP, and policed DSCP.

1. Enable QoS

Command	Explanation
Global Mode	
mls qos **no mls qos**	Enable/disable QoS function.

2. Configure class map.

Command	Explanation
Global Mode	
class-map <*class-map-name*> **no class-map <*class-map-name*>**	Create a class map and enter class map mode; the '**no class-map <*class-map-name*>**' command deletes the specified class map.
match {access-group <*acl-index-or-name*> | ip dscp <*dscp-list*>| ip precedence <*ip-precedence-list*>| vlan <*vlan-list*>|*cos* <*cos-list*>} **no match {access-group | ip dscp | ip precedence | vlan |cos}**	Set matching criterion (classify data stream by ACL, DSCP, VLAN or priority, etc) for the class map; the '**no match {access-group | ip dscp | ip precedence | vlan |cos}**' command deletes specified matching criterion.

3. Configure a policy map.

Command	Explanation
Global Mode	
policy-map <*policy-map-name*> **no policy-map <*policy-map-name*>**	Create a policy map and enter policy map mode; the '**no policy-map**

	<*policy-map-name*>‘ command deletes the specified policy map.
class <*class-map-name*> **no class <*class-map-name*>**	After a policy map is created, it can be associated to a class. Different policy or new DSCP value can be applied to different data streams in class mode; the ‘**no class <*class-map-name*>**‘ command deletes the specified class.
set {ip dscp <*new-dscp*> | ip precedence <*new-precedence*>|*cos* <*new-cos*>} **no set {ip dscp| ip precedence |*cos*}**	Assign a new DSCP and IP precedence value for the classified traffic; the ‘**no set {ip dscp| ip precedence |*cos*}**’ command cancels the newly assigned value.
police <*rate-bps*> <*burst-byte*> [exceed-action {drop | policed-dscp-transmit}] **no police <*rate-bps*> <*burst-byte*> [exceed-action {drop | policed-dscp-transmit}]**	Configure a policy to classify traffic, data stream exceeding the limit will be dropped or degraded; the ‘**no police <*rate-kbps*> <*burst-kbyte*> [exceed-action {drop | policed-dscp-transmit}]**’ command deletes the specified policy.
mls qos aggregate-policer <*aggregate-policer-name*> <*rate-bps*> <*burst-byte*> exceed-action {drop |policed-dscp-transmit} **no mls qos aggregate-policer <*aggregate-policer-name*>**	Define a policy set, perform different actions to out-of-profile data streams, such as discard or degrade. This policy can be used in one policy map by several classes; the ‘**no mls qos aggregate-policer <*aggregate-policer-name*>**‘ command deletes the specified policy set.
police aggregate <*aggregate-policer-name*> **no police aggregate <*aggregate-policer-name*>**	Apply a policy set to classified traffic; the ‘**no police aggregate <*aggregate-policer-name*>**‘ command deletes the specified policy set.

4. Apply QoS to ports

Command	Explanation
Interface Mode	
mls qos trust [cos | dscp | port priority <*priority*>] **no mls qos trust**	Configure port trust; the ‘**no mls qos trust**’ command disables the current trust status of the port.
mls qos cos {<*default-cos*> } **no mls qos cos**	Configure the default CoS value of the port; the ‘**no mls qos cos**’ command restores the default setting.
service-policy {input <*policy-map-name*> | output <*policy-map-name*>} **no service-policy {input**	Apply a policy map to the specified port; the ‘**no service-policy {input <*policy-map-name*> | output <*policy-map-name*>}**’ command deletes

<*policy-map-name*> | output <*policy-map-name*>}	the specified policy map applied to the port. Egress policy map is not supported yet.
mls qos dscp-mutation **no mls qos dscp-mutation**	Apply DSCP mutation mapping to the port; the '**no mls qos dscp-mutation** command restores the DSCP mutation mapping default.

5. Configure queue out method and weight

Command	Explanation
Interface Mode	
wrr-queue bandwidth <*weight1 weight2 weight3 weight4*> **no wrr-queue bandwidth**	Set the WRR weight for specified egress queue; the '**no wrr-queue bandwidth**' command restores the default setting.
priority-queue out **no priority-queue out**	Configure queue out method to pq method; the '**no priority-queue out**' command restores the default WRR queue out method.
wrr-queue cos-map <*queue-id*> <*cos1 ... cos8*> **no wrr-queue cos-map [<*queue-id*>]**	Set CoS value mapping to specified egress queue; the '**no wrr-queue cos-map[<*queue-id*>]**' command restores the default setting.

6. Configure QoS mapping

Command	Explanation
Global Mode	
mls qos map {cos-dscp <*dscp1...dscp8*> | dscp-cos <*dscp-list*> to <*cos*> | dscp-mutation <*in-dscp*> to <*out-dscp*> | policed-dscp <*dscp-list*> to <*mark-down-dscp*>} **no mls qos map {cos-dscp | dscp-cos | dscp-mutation | policed-dscp}**	Set CoS to DSCP mapping, DSCP to CoS mapping, DSCP to DSCP mutation mapping, IP precedence to DSCP and policed DSCP mapping; the '**no**'command restores the default mapping.

24.2.2 QoS Command List

24.2.2.1 mls qos

Command: mls qos
no mls qos

Function: Enable QoS in Global Mode; the '**no mls qos**' command disables the global QoS.

Command mode: Global Mode
Default: QoS is disabled by default.
Usage Guide: QoS provides 8 queues to handle traffics of 8 priorities. This function cannot be used with the traffic control function.
Example: Enable and then disabling the QoS function.
Switch(config)#mls qos
Switch(config)#no mls qos

24.2.2.2 class-map

Command: class-map <*class-map-name*>
no class-map <*class-map-name*>
Function: Create a class map and enters class map mode; the '**no class-map <*class-map-name*>**' command deletes the specified class map.
Parameters: <*class-map-name*> is the class map name**.**
Default: No class map is configured by default.
Command mode: Global Mode
Usage Guide: N/A
Example: Create and then deleting a class map named 'c1'.
Switch(config)#class-map c1
Switch(config)#no class-map c1

24.2.2.3 match

Command: match {access-group <*acl-index-or-name*> | ip dscp <*dscp-list*>| ip precedence <*ip-precedence-list*>|vlan <*vlan-list*>|cos<*cost-list*>}
no match {access-group | ip dscp | ip precedence | vlan |cos }
Function: Configure the match standard of the class map; the 'no' form of this command deletes the specified match standard..
Parameter: access-group <*acl-index-or-name*> match specified ACL,the parameters are the number or name of the ACL;**ip dscp <*dscp-list*>** match specified DSCP value, the parameter is a list of DSCP consisting of maximum 8 DSCP values;**ip precedence <*ip-precedence-list*>** match specified IP Precedence, the parameter is a IP Precedence list consisting of maximum 8 IP Precedence values with a valid range of 0～7; **vlan *vlan-list*>** match specified VLAN ID, the parameter is a VLAN ID list consisting of maximum 8 VLAN IDs. ***<cost-list>*** match specified cos value, the parameter is a COS list consisting of maximum 8 Cos.
Default: No match standard by default
Command mode: Class-map Mode
Usage Guide: Only one match standard can be configured in a class map. When configuring match the ACL, only the permit rule is available in the ACL except for PBR.
Example: Create a class-map named c1, and configure the class rule of this class-map to match packets with IP Precedence of 0.1.
Switch(config)#class-map c1

Switch(config-ClassMap)#match ip precedence 0 1
Switch(config-ClassMap)#exit

24.2.2.4 policy-map

Command: policy-map <*policy-map-name*>
no policy-map <*policy-map-name*>
Function: Create a policy map and enters the policy map mode; the '**no policy-map <*policy-map-name*>**' command deletes the specified policy map.
Parameters: < *policy-map-name*> is the policy map name.
Default: No policy map is configured by default.
Command mode: Global Mode
Usage Guide: QoS classification matching and marking operations can be done in the policy map configuration mode.
Example: Create and deleting a policy map named 'p1'.
Switch(config)#policy-map p1
Switch(config)#no policy-map p1

24.2.2.5 class

Command: class <*class-map-name*>
no class <class-map-name>
Function: Associate a class to a policy map and enters the policy class map mode; the '**no class <*class-map-name*>**' command deletes the specified class.
Parameters: < *class-map-name*> is the class map name used by the class.
Default: No policy class is configured by default.
Command mode: Policy map configuration Mode
Usage Guide: Before setting up a policy class, a policy map should be created and the policy map mode entered. In the policy map mode, classification and policy configuration can be performed on packet traffic classified by class map.
Example: Enter a policy class mode.
Switch(config)#policy-map p1
Switch(config-PolicyMap)#class c1
Switch(config--Policy-Class)#exit

24.2.2.6 set

Command: set {ip dscp <*new-dscp*> | ip precedence <*new-precedence*>|<*new-flowlabel*|cos<*new cos*>>}
no set {ip dscp | ip precedence|cos<*new cos*>}
Function: Assign a new DSCP, IP Precedence, IPv6 DSCP or IPv6 FL for the classified traffic; the 'no' form of this command delete assigning the new values
Parameter: <*new-dscp*> new DSCP value;**<*new-precedence*>** new IP Precedence; **<*new cos*>}** new COS value

Default: Not assigning by default

Command mode: Policy Class-map Mode

Usage Guide: Only the classified traffic which matches the matching standard will be assigned with the new values.

Example: Set the IP Precedence of the packets matching the c1 class rule to 3.

```
Switch(config)#policy-map p1
Switch(config-PolicyMap)#class c1
Switch(config--Policy-Class)#set ip precedence 3
Switch(config--Policy-Class)#exit
Switch(config-PolicyMap)#exit
```

24.2.2.7 police

Command: police <*rate-bps*> <*burst-byte*> [exceed-action {drop|policed-dscp-transmit}]
no police <*rate-bps*> <*burst-byte*> [exceed-action {drop|policed-dscp-transmit}]

Function: Configure a policy to a classified traffic; the '**no police <*rate-kbps*> <*burst-kbyte*> [exceed-action {drop | policed-dscp-transmit}]**' command deletes the specified policy.

Parameters: <*rate-kbps*> is the average baud rate (kb/s) of classified traffic, ranging from 1 to 10,000,000; **<*burst-kbyte*>** is the burst baud rate (kbyte) of classified traffic, ranging from 1 to 1000,000; **exceed-action drop** means drop packets when specified speed is exceeded; **exceed-action policed-dscp-transmit** specifies to mark down packet DSCP value according to **policed-dscp** mapping when specified speed is exceeded.

Default: There is no policy by default.

Command mode: Policy class map configuration Mode

Usage Guide: The ranges of **<*rate-kbps*>** and **<*burst-kbyte*>** are quite large, if the setting exceeds the actual speed of the port, the policy map applying this policy will not bind to switch ports.

Example: Set the bandwidth for packets that matching c1 class rule to 20 Mbps, with a burst value of 2 MB, all packets exceed this bandwidth setting will be dropped.

```
Switch(config)#policy-map p1
Switch(config-PolicyMap)#class c1
Switch(config--Policy-Class)#police 20000000 20000 exceed-action drop
Switch(config--Policy-Class)#exit
Switch(config-PolicyMap)#exit
```

24.2.2.8 mls qos aggregate-policer

Command: mls qos aggregate-policer <*aggregate-policer-name*> <*rate-kbps*> <*burst-kbyte*> exceed-action {drop |policed-dscp-transmit}
no mls qos aggregate-policer <*aggregate-policer-name*>

Function: Define a policy set that can be used in one policy map by several classes; the '**no mls qos aggregate-policer <*aggregate-policer-name*>**' command deletes the specified policy set.

Parameters: <*aggregate-policer-name*> is the name of the policy set; **<*rate-kbps*>** is the average baud rate (in kb/s) of classified traffic, range from 1 to 10,000,000; **<*burst-kbyte*>** is the burst value (in kb/s) for classified traffic, range from 1 to 1,000,000; **exceed-action drop** means drop packets when specified speed is exceeded; **exceed-action policed-dscp-transmit** specifies to mark down packet DSCP value according to **policed-dscp** mapping when specified speed is exceeded.

Default: No policy set is configured by default.

Command mode: Global Mode

Usage Guide: If a policy set is using by a policy map, it cannot be deleted unless the reference to the policy set is cleared in the appropriate policy map with '**no policer aggregate <*aggregate-policer-name*>**' command. The delete should be performed in Global Mode with '**no mls qos gregate-policer<*aggregate-policer-name*>**' command.

Example: Set a policy set named 'agg1', the policy set defines the bandwidth for packets of up to 20 Mbps, with a burst value of 2 MB. All packets exceeding this bandwidth setting will be dropped.

Switch(config)#mls qos aggregate-policer agg1 20000000 20000 exceed-action drop

24.2.2.9 police aggregate

Command: police aggregate <*aggregate-policer-name*>
no police aggregate <*aggregate-policer-name*>

Function: Apply a policy set to classified traffic; the '**no police aggregate <*aggregate-policer-name*>**' command deletes the specified policy set.

Parameters: <*aggregate-policer-name*> is the policy set name.

Default: No policy set is configured by default.

Command mode: Policy class map configuration Mode

Usage Guide: The same policy set can be referred to by different policy class maps.

Example: Apply a policy set 'agg1' to packets satisfying c1 class rule.

Switch(config)#policy-map p1
Switch(config-PolicyMap)#class c1
Switch(config--Policy-Class)#police aggregate agg1
Switch(config--Policy-Class)#exit
Switch(config-PolicyMap)#exit

24.2.2.10 mls qos trust

Command : mls qos trust {cos|dscp|port priority <*priority*>}
no mls qos trust

Function: Configure port trust; the '**no mls qos trust**' command disables the current trust status of the port.

Parameters: cos configures the port to trust CoS value; **dscp** configures the port to

trust DSCP value; **port priority <*cos*>** assigns a priority to the physical port, **cos** is the priority to be assigned.
Default: No trust.
Command mode: Interface Mode
Example: Configure Ethernet port 0/0/1 to trust CoS value, i.e., classifying the packets awitch(ccording to CoS value, DSCP value should not be changed.
Sconfig)#interface ethernet 0/0/1
Switch(Config-Ethernet0/0/1)#mls qos trust cos

24.2.2.11 mls qos cos

Command: mls qos cos {<*default-cos*> }
no mls qos cos
Function: Configure the default CoS value of the port; the '**no mls qos cos**' command restores the default setting.
Parameters: < *default-cos*> is the default CoS value for the port, the valid range is 0 to 7.
Default: The default CoS value is 0.
Command mode: Interface Mode
Usage Guide: none
Example: Set the default CoS value of Ethernet port 1/1 to 5, i.e., packets coming in through this port will be assigned a default CoS value of 5 if no CoS value present.
Switch(config)#interface ethernet 0/0/1
Switch(Config-Ethernet0/0/1)#mls qos cos 5

24.2.2.12 service-policy

Command: service-policy {input <*policy-map-name*>|output <*policy-map-name*>}
no service-policy {input <*policy-map-name*>|output <*policy-map-name*>}
Function: Apply a policy map to the specified port; the '**no service-policy input <*policy-map-name*>**' command deletes the specified policy map applied to the port.
Parameters: input <*policy-map-name*> applies the specified policy map to the ingress of switch port.
Default: No policy map is bound to ports by default.
Command mode: Interface Mode
Usage Guide: Configuring port trust status and applying policy map on the port are two conflicting operations; the later configuration will override the earlier configuration. Only one policy map can be applied to each direction of each port. Egress policy map is not supported yet.
Example: Bind policy p1 to ingress Ethernet port 0/0/1
Switch(config)#interface ethernet 0/0/1
Switch(Config-Ethernet0/0/1)# service-policy input p1

24.2.2.13 mls qos dscp-mutation

Command: mls qos dscp-mutation <*dscp-mutation-name*>
no mls qos dscp-mutation <*dscp-mutation-name*>

Function: Apply DSCP mutation mapping to the port; the '**no mls qos dscp-mutation <*dscp-mutation-name*>**' command restores the DSCP mutation mapping default.

Parameters: <*dscp-mutation-name*> is the name of DSCP mutation mapping.

Default: There is no policy by default.

Command mode: Interface Mode

Usage Guide: For configuration of DSCP mutation mapping on the port to take effect, the trust status of that port must be '**trust DSCP**'. Applying DSCP mutation mapping allows DSCP values specified directly to be converted into new DSCP values without class and policy process. DSCP mutation mapping is effective to the local port only. The 'trust DSCP' refers to the DSCP value before DSCP mutation in this case.

Example: Configure Ethernet port 1/1 to trust DSCP, using DSCP mutation mapping of mu1.

Switch(config)#interface ethernet 0/0/1
Switch(Config-Ethernet0/0/1)#mls qos trust dscp
Switch(Config-Ethernet0/0/1)#mls qos dscp-mutation

24.2.2.14 wrr-queue bandwidth

Command: wrr-queue bandwidth <*weight1 weight2 weight3 weight4*>
no wrr-queue bandwidth

Function: Set the WRR weight for specified egress queue; the '**no wrr-queue bandwidth**' command restores the default setting.

Parameters: <*weight1 weight2 weight3 weight4 weight5 weight6 weight7 weight8*> are WRR weights, ranging from 0 to 15.

Default: The default values of weight1 to weight8 are 1 through 8.

Command mode: Interface Mode

Usage Guide: The absolute value of WRR is meaningless. WRR allocates bandwidth by using eight weight values. If a weight is 0, then the queue has the highest priority; when the weights of multiple queues are set to 0, then the queue of higher order has the higher priority.

Example: Set the bandwidth weight proportion of the eight queue out to be 1:1:2:2:4:4:8:8.

Switch(Config)#wrr-queue bandwidth 1 2 4 8

24.2.2.15 priority-queue out

Command: priority-queue out
no priority-queue out

Function: Configure the working mode of the queue as prioritized queue mode or WRR mode.

Parameters: None.

Defautl: Non-priority-queue mode.

Command mode: Global Mode.
Usage Guide: When this command is configured, packets will not be forwarded through the WRR algorithm, but be forworded queue by queue.
Example: Configure enable the prioritized queue.
Switch(config)#priority-queue out

24.2.2.16 wrr-queue cos-map

Command: **wrr-queue cos-map <*queue-id*> <*cos1 ... cos8*>**
no wrr-queue cos-map
Function: Set the CoS value mapping to the specified queue out; the '**no wrr-queue cos-map**' command restores the default setting.
Parameters: **<*queue-id*>** is the ID of queue out, ranging from 1 to 8; **<*cos1 ... cos8*>** are CoS values mapping to the queue out, ranging from 0 -7, up to 8 values are supported.
Default: ***Default CoS-to-Egress-Queue Map when QoS is Enabled***

CoS Value	0 1 2 3 4 5 6 7
Queue Selected	1 2 3 4 5 6 7 8

Command mode: Global Mode
Usage Guide: none
Example: Map packets with CoS value 2 and 3 to egress queue 1.
Switch(config)#wrr-queue cos-map 1 2 3

24.2.2.17 mls qos map

Command: **mls qos map {cos-dscp <*dscp1...dscp8*> | dscp-cos <*dscp-list*> to <*cos*> | dscp-mutation <*dscp-mutation-name*> <*in-dscp*> to <*out-dscp*> |ip-prec-dscp <*dscp1...dscp8*> | policed-dscp <*dscp-list*> to <*mark-down-dscp*>}**
no mls qos map {cos-dscp | dscp-cos | dscp-mutation <*dscp-mutation-name*> | ip-prec-dscp | policed-dscp}
Function: Set **class of service (CoS)-to-Differentiated Services Code Point (DSCP)** mapping, **DSCP to CoS** mapping, **DSCP to DSCP mutation** mapping, **IP precedence to DSCP** and **policed DSCP** mapping; the '**no mls qos map {cos-dscp | dscp-cos | dscp-mutation <*dscp-mutation-name*> | ip-prec-dscp | policed-dscp}**' command restores the default mapping.
Parameters: **cos-dscp <*dscp1...dscp8*>** defines the mapping from CoS value to DSCP, **<*dscp1...dscp8*>** are the 8 DSCP value corresponding to the 0 to 7 CoS value, each DSCP value is delimited with space, ranging from 0 to 63;
dscp-cos <*dscp-list*> to <*cos*> defines the mapping from DSCP to CoS value, **<*dscp-list*>** is a list of DSCP value consisting of up to 8 DSCP values, **<*cos*>** are the CoS values corresponding to the DSCP values in the list;
dscp-mutation <*dscp-mutation-name*> <*in-dscp*> to <*out-dscp*> defines the mapping from DSCP to DSCP mutation, **<*dscp-mutation-name*>** is the name for mutation mapping, **<*in-dscp*>** stand for incoming DSCP values, up to 8 values are

supported, each DSCP value is delimited with space, ranging from 0 to 63, ***<out-dscp>*** is the sole outgoing DSCP value, the 8 values defined in incoming DSCP will be converted to outgoing DSCP values;

ip-prec-dscp <*dscp1...dscp8*> defines the conversion from IP precedence to DSCP value, ***<dscp1...dscp8>*** are 8 DSCP values corresponding to IP precedence 0 to 7, each DSCP value is delimited with space, ranging from 0 to 63; **policed-dscp <*dscp-list*> to <*mark-down-dscp*>** defines DSCP **mark down** mapping, where ***<dscp-list>*** is a list of DSCP values containing up to 8 DSCP values, ***<mark-down-dscp>*** are DSCP value after **mark down**.

Default: Default mapping values are:

Default CoS-to-DSCP Map

CoS Value	0 1 2 3 4 5 6 7
DSCP Value	0 8 16 24 32 40 48 56

Default DSCP-to-CoS Map

DSCP Value	0–7 8–15 16–23 24–31 32–39 40–47 48–55 56–63
CoS Value	0 1 2 3 4 5 6 7

Default IP-Precedence-to-DSCP Map

IP Precedence Value	0 1 2 3 4 5 6 7
DSCP Value	0 8 16 24 32 40 48 56

dscp-mutation and policed-dscp are not configured by default

Command mode: Global Mode

Usage Guide: In **police** command, classified packet traffic can be set to mark down if exceed specified average speed or burst value, **policed-dscp <*dscp-list*> to <*mark-down-dscp*>** can mark down the DSCP values of those packets to new DSCP 284 values.

Example: Set the ***CoS-to-DSCP*** mapping value to the default 0 8 16 24 32 40 48 56 to 0 1 2 3 4 5 6 7.

Switch(config)#mls qos map cos-dscp 0 1 2 3 4 5 6 7

24.3 QoS Example

Scenario 1:

Enable QoS function, change the queue out weight of port ethernet 0/0/1to 1: 2: 4: 8, and set the port in trust QoS mode without changing DSCP value, and set the default QoS value of the port to 5.

The configuration steps are listed below:

Switch#config
Switch(config)#mls qos
Switch(config)#wrr-queue bandwidth 1 2 4 8
Switch(config)#interface ethernet 0/0/1
Switch(config-Ethernet0/0/1)#mls qos trust cos
Switch(config-Ethernet0/0/1)#mls qos cos 5

Configuration result:

When QoS enabled in Global Mode, the egress queue bandwidth proportion of port ethernet 0/0/1 is 1: 2: 4: 8. When packets have CoS value coming in through port ethernet 0/0/1, it will be map to the queue out according to the CoS value, CoS value 0 to 7 correspond to queue out 1, 1, 2, 2, 3,3,4, 4, respectively. If the incoming packet has no CoS value, it is default to 5 and will be put in queue 6. All passing packets would not have their DSCP values changed.

Scenario 2:

In port ethernet 1/2, set the bandwidth for packets from segment 192.168.1.0 to 10 Mb/s, with a burst value of 4 MB, all packets exceed this bandwidth setting will be dropped.

The configuration steps are listed below:

```
Switch#config
Switch(config)#access-list 1 permit 192.168.1.0 0.0.0.255
Switch(config)#mls qos
Switch(config)#class-map c1
Switch(config-ClassMap)#match access-group 1
Switch(config-ClassMap)# exit
Switch(config)#policy-map p1
Switch(config-PolicyMap)#class c1
Switch(config--Policy-Class)#police 10000000 4000 exceed-action drop
Switch(config--Policy-Class)#exit
Switch(config-PolicyMap)#exit
Switch(config)#interface ethernet 0/0/2
Switch(Config-Ethernet0/0/2)#service-policy input p1
```

Configuration result:

An ACL name 1 is set to matching segment 192.168.1.0. Enable QoS globally, create a class map named c1, matching ACL1 in class map; create another policy map named p1 and refer to c1 in p1, set appropriate policies to limit bandwidth and burst value. Apply this policy map on port ethernet 0/0/2. After the above settings done, bandwidth for packets from segment 192.168.1.0 through port ethernet 0/0/2 is set to 10 Mb/s, with a burst value of 4 MB, all packets exceed this bandwidth setting in that segment will be dropped.

Scenario 3

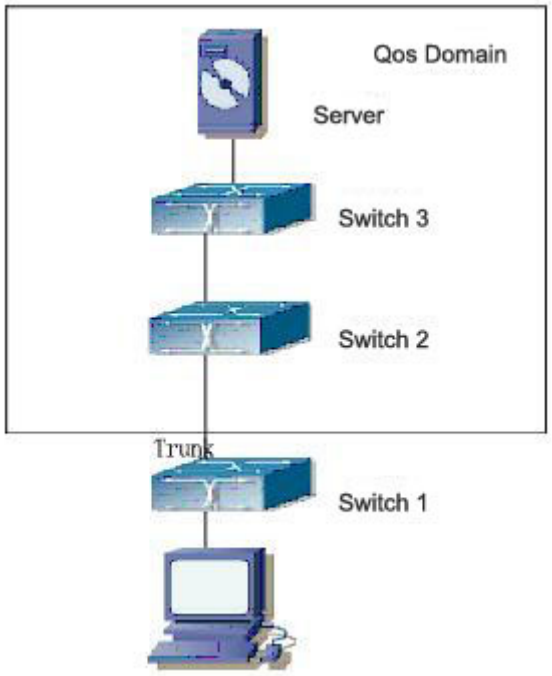


Fig 24-7 Typical QoS topology

As shown in the figure, inside the block is a QoS domain, SwitchA classifies different traffics and assigns different IP precedences. For example, set IP precedence for packets from segment 192.168.1.0 to 5 on port ethernet 1/1. The port connecting to switch2 is a trunk port. In SwitchB, set port ethernet 1/1 that connecting to swtich1 to trust IP precedence. Thus inside the QoS domain, packets of different priorities will go to different queues and get different bandwidth.

The configuration steps are listed below:

QoS configuration in Switch1:

Switch#config
Switch(config)#access-list 1 permit 192.168.1.0 0.0.0.255
Switch(config)#mls qos
Switch(config)#class-map c1
Switch(config-ClassMap)#match access-group 1
Switch(config-ClassMap)# exit
Switch(config)#policy-map p1
Switch(config-PolicyMap)#class c1
Switch(config--Policy-Class)#set ip precedence 5
Switch(config--Policy-Class)#exit
Switch(config-PolicyMap)#exit
Switch(config)#interface ethernet 0/0/1
Switch(Config-Ethernet0/0/1)#service-policy input p1

QoS configuration in Switch2：

Switch#config
Switch(config)#mls qos

```
Switch(config)#interface ethernet 0/0/1
Switch(config-Ethernet0/0/1)#mls qos trust cos
```

24.4 QoS Troubleshooting

24.4.1 QoS Monitor and Debug Command List

24.4.1.1 show mls-qos

Command: show mls-qos
Function: Display global configuration information for QoS.
Parameters: N/A.
Default: N/A
Command mode: Admin Mode

Displayed information	Explanation
Qos is enabled	QoS is enabled.

24.4.1.2 show mls qos aggregate-policer

Command: show mls qos aggregate-policer [<aggregate-policer-name>]
Function: Display policy set configuration information for QoS.
Parameters: <*aggregate-policer-name*> is the policy set name.
Default: N/A.
Command mode: Admin Mode

Displayed information	Explanation
aggregate-policer policer1 80000 80 exceed-action drop	Configuration for this policy set.
Not used by any policy map	Time that the policy set is being referred to

24.4.1.3 show mls qos interface

Command: show mls qos interface [<*interface-id*>] [buffers | policers | queueing | statistics]
Function: Display QoS configuration information on a port.
Parameters: <***interface-id***> is the port ID; **buffers** is the queue buffer setting on the port; **policers** is the policy setting on the port; **queuing** is the queue setting for the port; **statistics** is the number of packets allowed to pass for in-profile and out-of-profile traffic according to the policy bound to the port.
Default: N/A.

Command mode: Admin Mode

Displayed information	Explanation
Ethernet1/2	Port name
default cos:0	Default CoS value of the port.
DSCP Mutation Map: Default DSCP Mutation Map	Port DSCP map name
Attached policy-map for Ingress: p1	Policy name bound to port.

Displayed information	Explanation
Ethernet0/0/2	Port name
buffer size of 4 queue:256 256 256 256	Available buffer number for all 4 queues out on the port, this is a fixed setting that cannot be changed.

Displayed information	Explanation
Cos-queue map: Cos 0 1 2 3 4 5 6 7 Queue 1 1 2 2 3 3 4 4	CoS value to queue mapping.
Queue and weight type: q1 q2 q3 q4 QType 1 2 4 8 WFQ	Queue to weight mapping.

Displayed information	Explanation
Ethernet1/2	Port name
Attached policy-map for Ingress: p1	Policy map bound to the port.

Displayed information	Explanation
Ethernet1/2	Port name
ClassMap	Name of the Class map
Classified	Total data packets match this class map.
In-profile	Total in-profile data packets match this class map.
out-profile	Total out-profile data packets match this class map.

24.4.1.4 show mls qos maps

Command：show mls qos maps [cos-dscp | dscp-cos | dscp-mutation | policed-dscp]

Function: Display mapping configuration information for QoS.

Parameter: cos-dscp CoS for CoS-DSCP; **dscp-cos** DSCP for DSCP-CoS,

dscp-mutation for DSCP-DSCP mutation, **policed-dscp** is DSCP mark down mapping
Default: N/A.
Command mode: Admin Mode

24.4.1.5 show class-map

Command: show class-map [<class-map-name>]
Function: Display class map of QoS.
Parameter: < *class-map-name*> is the class map name.
Default: N/A.
Command mode: Admin Mode
Usage Guide: Display all configured class-map or specified class-map information.
Example:
Switch # show class-map
Class map name:c1
Match acl name:1

Displayed information	Explanation
Class map name:c1	Name of the Class map
Match acl name:1	Classifying rule for the class map.

24.4.1.6 show policy-map

Command: show policy-map [<policy-map-name>]
Function: Display policy map of QoS.
Parameter: < *policy-map-name*> is the policy map name.
Default: None.
Command mode: Admin Mode

Displayed information	Explanation
Policy Map p1	name of policy map
Class map name:c1	Name of the class map referred to
police 16000000 8000 exceed-action drop	Policy implemented

24.4.2 QoS Troubleshooting

☞ QoS is disabled on switch ports by default, 4 sending queues are set by default, queue1 forwards normal packages, other queues are used for some important control

packets (such as BPDU). Choose an array according to the Cos value when QoS is shut down

- ☞ When QoS is enabled in Global Mode,. QoS is enabled on all ports with 4 traffic queues. The default CoS value of the port is 0; port is in not Trusted state by default; the default queue weight values are 1, 2, 4, 8 in order, all QoS Map is using the default value.
- ☞ CoS value 7 maps to queue 4 that has the highest priority and usually reserved for certain protocol packets. It is not recommended for the user to change the mapping between CoS 7 to Queue 4, or set the default port CoS value to 7.
- ☞ Policy map can only be bound to ingress direction, egress is not supported yet.
- ☞ If the policy is too complex to be configured due to hardware resource limit, error massages will be provided.

Chapter 25 Layer 3 Configuration

DCS-3950 series switch only supports layer 2 forwarding function. But, we can configure a layer3 control port. On the interface of this port we can configure IP addresses used in communication of various IP-based control protocols.

25.1 Layer 3 Interface

25.1.1 Introduction to Layer 3 Interface

Layer3 interface can be created on DCS-3950 series. Layer3 interface is not physical interface but a virtual interface. Layer3 interface is built on VLAN. Layer3 interface can contain one or more layer2 interface of the same VLAN, or no layer2 interfaces. At least one of Layer2 interfaces contained in Layer3 interface should be in UP state for Layer3 interface in the UP state, otherwise, Layer3 interface will be in the DOWN state. All layer3 interface in the switch use the same MAC address, this address is selected from the reserved MAC address on creating Layer3 interface. Layer3 interface is the base for layer3 protocols. The switch can use the IP address set in layer3 interface to communicate with the other devices via IP. The switch can forward IP packets between different Layer3 interfaces.

25.1.2 Layer3 interface configuration

25.1.2.1 Layer3 Interface Configuration Task Sequence

1. Create Layer3 Interface
2. Set the default gateway address of the switch

1. Create Layer3 Interface

Command	Explanation
Global Mode	
interface vlan <*vlan-id*> **no interface vlan <*vlan-id*>**	Create a VLAN interface (VLAN interface is a Layer3 interface); the '**no interface vlan <*vlan-id*>**' command deletes the VLAN interface (Layer3 interface) created in the switch.
Global Mode	
ip route 0.0.0.0 0.0.0.0 <gateway> **no ip route 0.0.0.0 0.0.0.0 <gateway>**	Set the default gateway address of the switch; prefixing this command with 'no' will

	delete the default gateway address.

25.1.2.2 Layer 3 Interface Command List

25.1.2.2.1interface vlan

Command: interface vlan <*vlan-id*>
no interface vlan <*vlan-id*>
Function: Create a VLAN interface (a Layer 3 interface); the '**no interface vlan <*vlan-id*>**' command deletes the Layer 3 interface specified.
Parameters: <*vlan-id*> is the VLAN ID of the established VLAN.
Default: No Layer 3 interface is configured upon switch shipment.
Command mode: Global Mode
Usage Guide: When creating a VLAN interface (Layer 3 interface), VLANs should be configured first, for details, see the VLAN chapters. When VLAN interface (Layer 3 interface) is created with this command, the VLAN interface (Layer 3 interface) configuration mode will be entered. After the creation of the VLAN interface (Layer 3 interface), interface vlan command can still be used to enter Layer 3 interface mode.
Example: Create a VLAN interface (layer 3 interface).
Switch (Config)#interface vlan 1

25.1.2.2.2ip route

Command: ip route 0.0.0.0 0.0.0.0 <*gateway*>
no ip route 0.0.0.0 0.0.0.0 <*gateway*>
Function: To configure the default route for the switch. If no is put in front of the command, If no is put in front of the command, the default route will be removed.
Parameters: <*gateway*> is the gateway for the default route, which is presented in dotted decimal.
Command mode: Global Mode
Default: Default route is not configured by default.
Usage Guide: For Layer 3 interfaces, the gateway for the default route must be in the same subnet with the Layer 3 interface of the switch. For Layer 2 interfaces, only the gateway for 0/0 can be configured.
Example: For a Layer 3 interface with 2.2.2.2 as its IP address, and 255.255.255.0 as its net mask, to configure the 2.2.2.1 as the gateway's IP address for the default route.
Switch(Config)#ip route 0.0.0.0 0.0.0.0 2.2.2.1

25.1.2.3 Layer 3 Interface debugging Command list

25.1.2.3.1show ip traffic

Command: show ip traffic
Function: Display statistics for IP packets.
Command mode: Admin Mode
Usage Guide: Display statistics for IP and ICMP packets received/sent.
Example:

```
Switch #show ip traffic
IP statistics:
  Rcvd:   896 total, 0 local destination
          0 header errors, 0 address errors
          0 unknown protocol, 0 discards
  Frags: 0 reassembled, 0 timeouts
          0 fragment rcvd, 0 fragment dropped
          0 fragmented, 0 couldn't fragment, 0 fragment sent
  Sent:   1277 generated, 0 forwarded
          0 dropped, 0 no route
ICMP statistics:
  Rcvd:   0 total 0 errors 0 time exceeded
          0 redirects, 0 unreachable, 0 echo, 0 echo replies
          0 mask requests, 0 mask replies, 0 quench
          0 parameter, 0 timestamp, 0 timestamp replies
  Sent:   0 total 0 errors 0 time exceeded
          0 redirects, 0 unreachable, 0 echo, 0 echo replies
          0 mask requests, 0 mask replies, 0 quench
          0 parameter, 0 timestamp, 0 timestamp replies
TCP statistics:
  TcpActiveOpens          2, TcpAttemptFails          0
  TcpCurrEstab            1, TcpEstabResets           0
  TcpInErrs               0, TcpInSegs              896
  TcpMaxConn              0, TcpOutRsts              18
  TcpOutSegs           1277, TcpPassiveOpens          0
  TcpRetransSegs        262, TcpRtoAlgorithm         0
  TcpRtoMax               0, TcpRtoMin               0
UDP statics:
  UdpInDatagrams          0, UdpInErrors             0
  UdpNoPorts              0, UdpOutDatagrams         0
```

Displayed information	Notes
IP statistics：	IP packet statistics.
Rcvd： 290 total, 44 local destination 0 header errors, 0 address errors 0 unknown protocol, 0 discards	Statistics of total packets received, number of packets reached local destination, number of packets have header errors, number of erroneous addresses, number of packets of unknown protocols, number of

	packets dropped.
Frags： 0 reassembled, 0 timeouts 0 fragment rcvd, 0 fragment dropped 0 fragmented, 0 couldn't fragment, 0 fragment sent	Fragmentation statistics: number of packets reassembled, timeouts, fragments received, fragments discarded, packets that cannot be fragmented, number of fragments sent, etc.
Sent： 0 generated, 0 forwarded 0 dropped, 0 no route	Statistics for total packets sent, including number of local packets, forwarded packets, dropped packets and packets without route.
ICMP statistics：	ICMP packet statistics.
Rcvd： 0 total 0 errors 0 time exceeded 0 redirects, 0 unreachable, 0 echo, 0 echo replies 0 mask requests, 0 mask replies, 0 quench 0 parameter, 0 timestamp, 0 timestamp replies	Statistics of total ICMP packets received and classified information.
Sent： 0 total 0 errors 0 time exceeded 0 redirects, 0 unreachable, 0 echo, 0 echo replies 0 mask requests, 0 mask replies, 0 quench 0 parameter, 0 timestamp, 0 timestamp replies	Statistics of total ICMP packets sent and classified information.
TCP statistics:	TCP packet statistics.
TcpActiveOpens 2, TcpAttemptFails 0 TcpCurrEstab 1, TcpEstabResets 0 TcpInErrs 0, TcpInSegs 896 TcpMaxConn 0, TcpOutRsts 18 TcpOutSegs 1277, TcpPassiveOpens 0 TcpRetransSegs 262, TcpRtoAlgorithm 0 TcpRtoMax 0, TcpRtoMin 0	Number of active TCP connections, number of attempt fails of TCP connections, number of TCP RST messages that have been sent, number of error packets received, etc.
UDP statics:	UDP packet statistics.
UdpInDatagrams 0, UdpInErrors 0 UdpNoPorts 0,	Number of UDP packets received, number of error packets being received, number of UDP packets of destination port

UdpOutDatagrams	0	unreachable being received, number of UDP packets being sent.

25.1.2.3.2 debug ip packet

Command: debug ip packet
no debug ip packet
Function: Enable the IP packet debug function: the 'no debug IP packet' command disables this debug function.
Default: IP packet debugging information is disabled by default.
Command mode: Admin Mode
Usage Guide: Display statistics for IP packets received/sent, including source/destination address and bytes, etc.
Example: Enable IP packet debug.
Switch #debug ip packet
IP PACKET： rcvd, src 1.1.1.1, dst 1.1.1.2, size 100

25.1.2.3.3 show ip route

Command: show ip route [dest <*destination*>] [mask <*destMask*>] [nextHop <*nextHopValue*>] [protocol {connected | static | rip| ospf | ospf_ase | bgp | dvmrp}][<*vlan-id*>] [preference <*pref*>] [count]
Function: Display the routing table.
Parameters: <*destination*> is the destination network address；**<*destMask*>** is the network mask for the destination network；**<*nextHopValue*>** is the IP address of next hop；**connected** is for directly connected routing；**static** is for static routing；**rip** is for routing with RIP；**ospf** is for routing with OSPF；**ospf_ase** is for OSPF-ASE routing；**bgp** is for BGP routing；**dvmrp** is for DVMRP routing；**<*vlan-id*>** the ID of VLAN；**<*pref*>** is the priority of the route with its value defined as <0-255>；**count** is a counter for listing the routing entries。
Command mode: Admin Mode
Usage Guide: This command is used to display the routing table in the kernel, including routing types, destination network, network mask, the next hop address and interfaces, etc.
Example:
Switch#show ip route
Codes: C - connected, S - static, R - RIP derived, O - OSPF derived
A - OSPF ASE, B - BGP derived, D - DVMRP derived

	Destination	Mask	Nexthop	Interface	Preference
C	2.2.2.0	255.255.255.0	0.0.0.0	vlan2	0
C	4.4.4.0	255.255.255.0	0.0.0.0	vlan4	0
S	6.6.6.0	255.255.255.0	9.9.9.9	vlan9	1
R	7.7.7.0	255.255.255.0	8.8.8.8	vlan8	120

Displayed Information	Notes
C - connected	Directly connected routing.
S – static	Static routing, which is manually configured.
R - RIP derived	RIP routing, which is learned by Lay 3 switches through RIP protocol.
O - OSPF derived	OSPF routing, which is learned by Lay 3 switches, through the OSPF protocol.
A- OSPF ASE	OSPF-ASE routing.
B- BGP derived	BGP routing
D - DVMRP derived	DVMRP routing
Destination	Destination network
Mask	Destination network mask.
Nexthop	IP address of next hop.
Interface	The interface of Layer 3 switches for forwarding the packets to next hop.
Preference	Priority of the routing entry. If packets can reach the destination network through more than one route, the route with the highest priority will be chosen.

25.2 ARP

25.2.1 Introduction to ARP

ARP (Address Resolution Protocol) is mainly used in IP address to Ethernet MAC address resolution. DCS-3950 series supports static configuration.

25.2.2 ARP Configuration

25.2.2.1 ARP Configuration Task List

1. Configure static ARP

1. Configure static ARP

Command	Explanation
arp <*ip_address*> <*mac_address*> **no arp <*ip_address*>**	Configure a static ARP entry; the '**no arp <*ip_address*>**' command deletes a static ARP entry.

25.2.2.2 ARP Forwarding Command List

25.2.2.2.1arp

Command: arp <*ip_address*> <*mac_address*> {[ethernet] <*portName*>}
no arp <*ip_address*>
Function: Configure a static ARP entry; the '**no arp <*ip_address*>'** command deletes a static ARP entry.
Parameters: <*ip_address*> is the IP address; **<*mac_address*>** is the MAC address; **ethernet** stands for Ethernet port; **<*portName*>** for the name of layer2 port.
Default: No static ARP entry is set by default.
Command mode: Interface Mode
Usage Guide: Static ARP entries can be configured in the switch.
Example: Configure static ARP for interface VLAN1.
switch(Config-If-Vlan1) #arp 1.1.1.1 00-03-0f-f0-12-34 ethernet 0/0/1

25.2.3 ARP Forwarding Troubleshooting

25.2.3.1 Monitor and Debug Command List

25.2.3.1.1show arp

Command：show arp [<*ip-addr*>][<*vlan-id*>][<*hw-addr*>][type {static|dynamic}][count]
Function: Display the ARP table.
Parameter: <*ip-addr*> is a specified IP address; **<*vlan-id*>** stands for the entry for the identifier of specified VLAN; **<*hw-addr*>** for entry of specified MAC address; '**static**' for static ARP entry; '**dynamic**' for dynamic ARP entry; '**count**' displays number of ARP entries.
Command mode: Admin Mode
Usage Guide: Display the content of current ARP table such as IP address, MAC address, hardware type, interface name, etc.
Example:
Switch#sh arp
Total arp items is 1, the matched arp items is 1

Address	Hardware Addr	Interface	Port	Flag
2.2.2.66	00-10-00-00-00-C5	Vlan1	Ethernet0/0/13	Dynamic

Displayed Information	Explanation
Addrss	IP address of Arp entries: 2.2.2.66
Hardware Address	MAC address of Arp entries:

	00-10-00-00-00-C5
Interface	Layer3 interface corresponding to the ARP entry.
Port	Physical (Layer2) interface corresponding to the ARP entry.
Flag	Describes whether ARP entry is dynamic or static.

25.2.3.1.2debug arp

Command: debug arp
no debug arp

Function: Enable the ARP debug function: the '**no debug arp**' command disables this debug function.

Default: ARP debug is disabled by default.

Command mode: Admin Mode

Usage Guide: Display contents for ARP packets received/sent, including type, source and destination address, etc.

Example: Enable ARP debugging

Switch #debug arp

ARP：rcvd, type 1, src 1.1.1.1 1234.1234.1234, dst 1.1.1.2 5678.5678.5678

25.2.3.2 ARP Troubleshooting

If ping from the switch to directly connected network devices fails, the following can be used to check the possible cause and solution.

- Check whether the corresponding ARP has been learned by the switch.
- If ARP is not learned, then enabled ARP debug information and view sending/receiving condition of ARP packets.